JANUARY 1943

NO. 120

ASTM Bulletin

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ASTM BULLETIN

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JANUARY—1943

No. 120

ASTM BULLETIN

"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

TELEPHONE—PENnypacker 3545 | R. E. Hess, Editor | CABLE ADDRESS—TESTING

R. J. Painter, Associate Editor

Number 120 | January, 1943

Symposium on Paints for Civilian Defense and on Powder Metallurgy to Feature Buffalo Spring Meeting

Committee Week to Be Held Beginning March 1

UNDER THE ACTIVE direction of a Buffalo Committee on Arrangements and the new Western New York-Ontario District Committee, formal organization of the latter being announced later in this BULLETIN, plans are being completed for the two symposiums which will be the technical features of the Society's 1943 Spring Meeting, to be held at the Hotel Statler, Buffalo, N. Y., on Wednesday, March 3. The symposiums will cover powder metallurgy and paints for civilian defense, the latter title being a rather broad one to cover the major problems which will be covered in the several technical papers being developed.

The Spring Meeting will be held, as has been customary, during A.S.T.M. Committee Week which will begin on Monday, March 1. A number of Society committees, as indicated later, are planning to participate.

B. L. McCarthy, Wickwire Spencer Steel Co., is Chairman of the local group, with T. L. Mayer, Buffalo Public Library, Department of Technology, serving as secretary. W. H. Lutz, Pratt & Lambert, Inc., Vice-Chairman of the arrangements committee, has developed the paint symposium, with Mr. McCarthy doing the "spade" work for the Symposium on Powder Metallurgy.

The plans call for the paint symposium to be in two sessions, one on Wednesday morning beginning at 9:30 o'clock with the second session in the afternoon. In the morning session would be included the papers on raw materials and the one on water emulsion paints with the civilian defense coatings papers in the afternoon session, tentatively scheduled for 1:30 p.m. The powder metallurgy symposium is to be in the afternoon beginning at 2:00 o'clock, thus permitting those who might wish to hear a paper on concealment paints to do so and then attend the metallurgy session.

While there is no assurance that the technical papers will be published as a special symposium book, it is hoped that some of those participating will be able to submit extended abstracts for publication in the ASTM BULLETIN.

A copy of the final technical program with session times, presiding officers, and related information, will be mailed to members of the Society in advance of the meeting, and with this (at least to each member of committees participating in Committee Week) will be a schedule of the committee meetings, with related information.

DINNER

As indicated later in this BULLETIN, a new District Committee has been organized in the Buffalo-Rochester-Toronto area called the Western New York-Ontario District. This group brings the total of such District Committees to ten, others functioning in Philadelphia, Chicago, Cleveland, Detroit, New York, Northern California, Pittsburgh, St. Louis, and Southern California. While this committee is distinct from the Buffalo Committee on Arrangements, a number of men are serving on both groups. The part of the meeting sponsored by the new District Committee will be a dinner on the evening of Wednesday, March 3, at which there will be outstanding speakers and an interesting program. Although there have not been formal dinner programs at recent A.S.T.M. meetings, the trend having been to smaller luncheon groups, particularly on the part of Society committees, our very enthusiastic Buffalo group feels that one should be arranged for the first meeting in the Buffalo District.

TECHNICAL COMMITTEE MEETINGS—COMMITTEE WEEK

While due to the emergency a number of the A.S.T.M. committees are postponing their decision to participate in Committee Week until later in February, a number of the groups have stated their intentions to participate as follows:

Subcommittee on Elevated Temperature Properties of Cast Iron, of A-3.
Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys
Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys and Subcommittees I, II, and VI
Committee B-7 on Light Metals and Alloys, Cast and Wrought, and certain subcommittees
Committee D-1 on Paint, Varnish, Lacquer, and Related Products, and Numerous Subcommittees
Committee D-5 on Coal and Coke, Subcommittees I, XIII, and XV.
Committee D-11 on Rubber Products, and Several Subcommittees
Committee E-1 sections
Advisory Committee on Corrosion

(over)

Important Standards Activities

Important new specifications and numerous emergency actions have been approved in important specifications. For details see article on page 8 in this BULLETIN. A complete list of Emergency Alternate Provisions appears on the last text pages

Edmund Hayes Hall on the University of Buffalo campus.

Cuts courtesy CHEMICAL AND ENGINEERING NEWS, American Chemical Society.

It is quite probable that a number of additional committees will also call meetings in Buffalo, thus taking advantage of the presence there of a number of their members who will undoubtedly be attending other sessions. A.S.T.M. Headquarters Staff will shortly start the detailed study of overlapping membership in various groups, leading to development of a schedule resulting in a minimum of conflicts in schedules. The schedule will be sent to the members promptly, in the realization that members will wish to make their railroad reservations as soon as possible. Hotel reservations can be made by writing directly to the Hotel Statler or awaiting receipt of the special reservation card which will be mailed to the members with the technical program and related information early in February.

About Buffalo

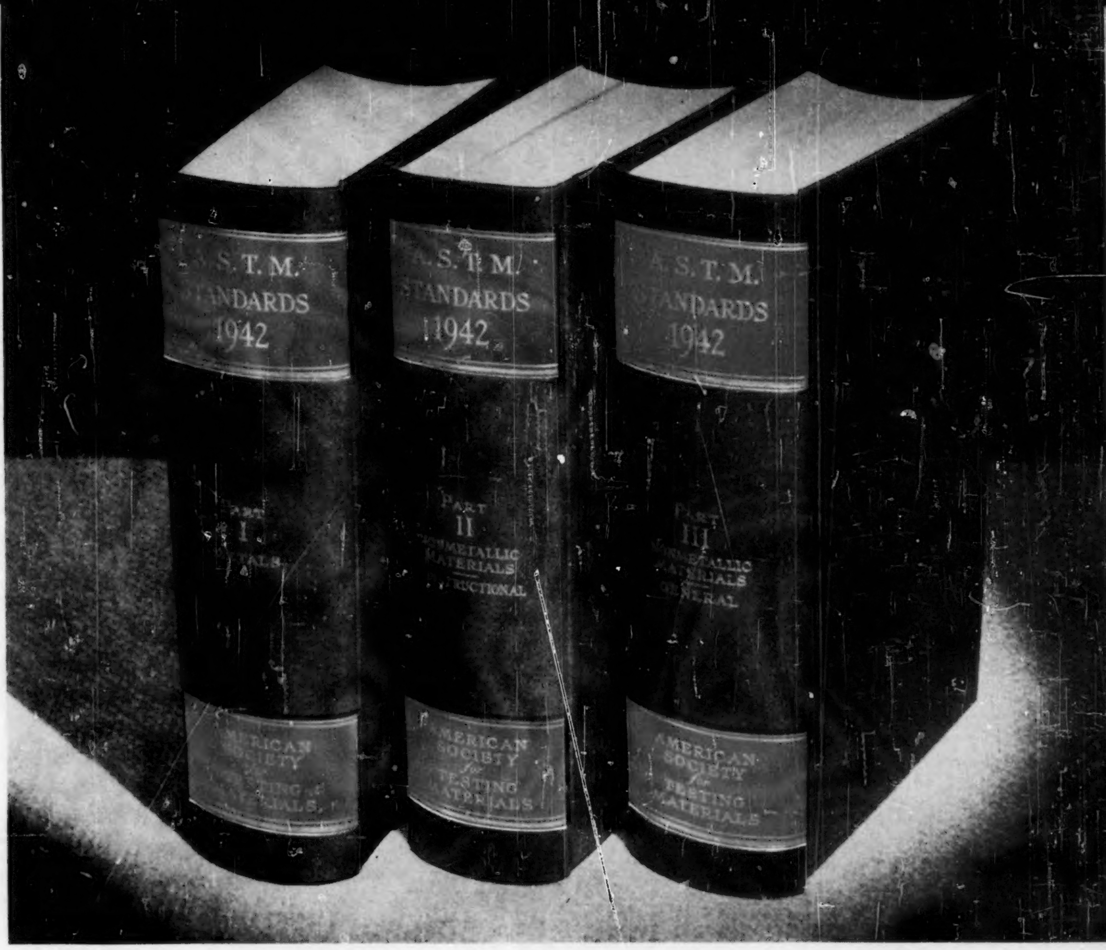
Where the 1943 Spring Meeting and Committee Week Will Be Held, March 1 to 5

BUFFALO HAS AN interesting historical background extending well back into the 18th century. Now the fourteenth city in size in the United States, its first permanent white settlers came in 1784. The Holland Land Co., in 1790 laid out plans for a town called New Amsterdam, and later during the war of 1812, the village then known as Buffalo, had about 1500 people. On December 30, 1813, a British garrison from Fort Erie with Indian allies attacked and burned the city, but it was quickly rebuilt, became an incorporated village in 1816, and, of course, entered a very remarkable boom period beginning, October 26, 1825, when the Erie Canal was opened reducing hauling costs from Lake Erie to the Hudson River from $100 to $10 a ton. The University of Buffalo received its charter from the state in 1846.

The Pan-American Exposition of 1901 brought renown to Buffalo, and also was the unfortunate scene of one of America's tragedies on December 6, 1901, when President McKinley was assassinated in the Hall of Music.

Now one of the country's leading industrial centers, Buffalo has many large and important plants for the manufacture of iron and steel and various non-ferrous metals and alloys, numerous constructional materials—cement, gypsum, and so forth. In Buffalo and neighboring communities are situated companies that are leaders in the field of production of electro chemicals, plastics, paints and varnishes, and other materials.

The first railroad station in Buffalo. It was succeeded by the Union Station on Exchange Street. Today a fine new station at Lovejoy Street houses the New York Central and the Pennsylvania. The Lehigh and the Lackawanna have their separate stations. *Below.* The twin pumps on the Terrace at Main Street, which was one of Buffalo's earliest sources of water supply. After a pumping station had been built and the water piped to the houses, many citizens continued to insist on drinking the pump water in preference to water in the conduits. "The pump water tasted right."



1942 Book of A.S.T.M. Standards

The Society's Most Extensive Publication Virtually Completed

Several days ago the last forms for the 1942 Book of A.S.T.M. Standards were released for press and as this Bulletin goes in the mails Part I on Metals, the last of the three parts of the 1942 book will be in course of binding. Distribution of Parts II and III has already been made. As previously, the book has been issued in three parts as follows:

Part I, Metals.—Ferrous and non-ferrous metals (all A and B and some E serial designations) except methods of chemical analysis. General testing methods (E serial designations).

Part II, Nonmetallic Materials—Constructional—Cementitous materials, concrete and aggregates, masonry building units, ceramics, pipe and tile, thermal insulating materials (all C serial designations). Timber and timber preservatives, paints, varnishes and lacquers, road materials, waterproofing and roofing materials, soils (certain D serial designations). General testing methods, thermometers (E serial designations).

Part III, Nonmetallic Materials—General.—Fuels, petroleum products, electrical insulating materials, rubber, textiles, soaps and detergents, paper, plastics, water (remainder of D serial designations). General testing methods, thermometers (E serial designations).

Although detailed study was made by the Society's Committee on Papers and Publications on various possibilities of issuing the 1942 standards, it was finally agreed that the current book would best serve its purposes by being issued in the style followed in 1939, namely, in three parts. Admittedly, this has resulted in very large books which are nearing the maximum size feasible for binding, and if the Society's work continues to expand as it most surely will, some new publication scheme will need to be used in 1945, normally the next year of publication.

Arrangement of Standards

With some minor differences the standards are arranged in the respective parts according to the general materials covered, following the 1939 system. All standards appear in the forepart of each book followed by a pink insert section which gives the emergency specifications, and the tentative specifications and tests are arranged in the back part of the volumes.

Grouping of the standards and of the tentative standards is by the fields covered; for example, all of the *standard* specifications for pipe and piping materials will be found grouped together; those on steel forgings are grouped, and castings, etc. This is the system generally used. Admittedly the editors have had to use judgment in this connection, but it has been felt preferable this year to use this system found reasonably satisfactory previously, rather than to arrange the standards and tentative standards in each book according to sequence of the serial designations. This latter has been used in some of the special compilations restricted to specific fields and is of decided convenience there.

The whole general arrangement of the books is constantly under study and members who may have comments are invited to submit them to the Publications Committee.

Indexes and Tables of Contents

In publications as extensive as the Book of Standards it is essential that complete indexes be included and

every facility be provided for ease of reference. It has always been the A.S.T.M. policy where possible to include very detailed indexes and the index for Part II of the 1942 volume, for example, covers some 32 pages—indicative of its detail. Each Part has a complete table of contents arranged according to the materials groupings and there is a second table of contents arranged in order of the serial designations. Those extremely familiar with the standards find the numeric sequence contents most helpful. Others use the table of contents arranged by materials. In either case recourse can be had to the complete index.

Facts About the Books

The following tables gives the number of standards, emergency specifications, and tentative standards in each part, and the total number of pages included. In all there are 1091 specifications, tests, definitions, both emergency and standard, which figure includes the 21 methods of chemical analysis of metals published in a separate volume.

1942 Book of Standards	Number of Standards	Number of Tentative Standards	Emergency Standards	Number of Pages	Copies Printed
Part I Metals	220	136	5	1690	9500
Part II Nonmetallic Materials—Constructional	293	108	13	1528	7400
Part III Nonmetallic Materials—General	197	150	1	1684	7400
Total	...	...	..	4902	24300
Volume on Chemical Analysis of Metals (Ready March 15)	3	18	0		

Actual Number of Standards (As of December 31)	691
Actual Number of Tentative Standards (as of December 31)	400
Actual Number of Emergency Standards	19
Total	1110
Duplications of Published Items—Parts II and III	29
Duplications of Published Items—Parts I, II, and III	4

Cover Design.—The binding of the book is substantially in conformance with specifications for the previous volume —a durable dark blue cloth, and the only difference in the backstrap design first issued in 1939 and very favorably received has been to increase the size of type for the year (1942).

1943–1944 Supplements

Since this book is published every three years, it is planned to issue Supplements in 1943 and 1944 giving all new specifications and tests, all tentative standards that have been formally adopted, and all revised material thus bringing the book completely up to date. There will be a Supplement for *each* part in 1943 and in 1944, to be issued late in each year.

Method of Furnishing the Book

As each member realizes, the Book of Standards is probably the Society's most important publication and a liberal policy is followed in connection with furnishing it to members, each member, whether individual or company receiving one part on his annual dues, with a nominal annual charge of $1.50 or $2.50 if two or all three parts, respectively, are desired, with Supplements.

Members can also procure extra copies of the book at considerably reduced prices, the scale for the 1942 volume being as follows:

Sales Prices (revised in 1942):
(Cloth Binding)

	Any One Part	Any Two Parts	All Three Parts
1942 Book of Standards, Parts, I, II, III:			
List Prices (non-members)	$9.00	$18.00	$27.00
Members Prices (for extra copies)	6.00	12.00	18.00
Supplements for 1943 and 1944:			
List Prices (non-members)—each year	3.00	6.00	9.00
Members Prices (for extra copies)—*each* year	2.00	4.00	6.00

For half-leather binding add $1.00 for each Part and each Supplement.

New Standards and Recent Emergency Actions

Bearing Alloys, Soft Solder Metal, Chemical Analysis of Metals, Non-Ferrous Metals and Alloys, Rubber Products, Steel Forgings and Pipe

During the past few weeks, the Society's Committee E-10 on Standards has approved a number of new tentative and emergency standards and on the recommendations of several committees has approved emergency alternate provisions in a number of specifications involving particularly non-ferrous metals and alloys.

New Tentative Standards

Committee E-3 on Chemical Analysis of Metals, responsible for most of the standards in the Volume on Chemical Analysis now in preparation and which is essentially a companion part of the Book of A.S.T.M. Standards, has developed two new tentative methods, one covering Analysis of Zinc-Base Alloy Die Castings (E 47–42 T) and the other, Chemical Analysis of Tin- and Lead-Base Solder Metal (E 46 – 42 T), the latter superseding the existing Tentative Methods of Chemical Analysis of Alloys of Lead, Tin, Antimony, and Copper (B 18 – 36 T). The standard for analysis of solder metal prescribes methods for determination of tin, arsenic, antimony, copper, bismuth, and iron. In this class of alloys content of lead is taken by difference. The committee is developing methods for determining zinc and aluminum in solder metal and when finally perfected these will undoubtedly be issued as a supplement to this standard E 46.

The other new method (E 47) covers the determination of lead, aluminum, copper, magnesium, cadmium and iron in zinc-base alloys, these materials being covered in the Tentative Specifications for Zinc-Base Alloy Die Castings (B 86 – 41 T).

Apparatus and Reagents.—Committee E-3 has also had under consideration for some time the development of

recommendations covering apparatus and reagents involved in chemical analysis and is about ready to submit a new standard which would be included for the first time in the 1942 Volume on Chemical Analysis of Metals.

Revision of Tentative Standards

Committee B-5 on Copper and Copper Alloys, Cast and Wrought, has written a number of product specifications in which reference is made to certain other standards covering base metal or alloys and it has recently agreed to incorporate a reference to the Tentative Specifications for Electrolytic Cathode Copper (B 115 – 41 T) as an alternate material for use in the following specifications:

B 19 – 42 T	(Cartridge Brass Sheet, Strip, etc.)
B 22 – 40 T	(Bronze Castings for Turntables and Movable Bridges)
B 36 – 41 T	(Brass Sheet and Strip)
B 121 – 41 T	(Leaded Brass Sheet and Strip)
B 122 – 39 T	(Copper-Nickel-Zinc and Copper-Nickel Alloy Sheet and Strip)
B 124 – 42 T	(Copper-Base Alloy Forging Rods, etc.)
B 129 – 40 T	(Cartridge Brass Cartridge Case Cups)
B 130 – 41 T	(Gilding Metal Sheet and Strip)
B 131 – 40 T	(Gilding Metal Bullet Jacket Cups)
B 135 – 42 T	(Miscellaneous Brass Tubes)
B 148 – 42 T	(Aluminum-Bronze Sand Castings)
B 169 – 41 T	(Aluminum Bronze Sheet and Strip)
B 171 – 42 T	(Copper-Alloy Condenser Tube Plates)

New Emergency Standards and Emergency Alternate Provisions

Steel Forgings and Pipe, Copper Wire, Copper Products, Rubber Products

A most important recent action (January, 1943) of the Committee on Standards has been the approval of several recommendations originating in the National Emergency Steel Specification Technical Advisory Committee on Heavy Forgings which cleared its work through Subcommittee VI on Steel Forgings and Billets of Committee A-1 on Steel. These involve seven complete emergency specifications covering heavy forgings primarily for use in turbines and turbine generators. Emergency provisions in two existing specifications take care of general heavy forging requirements and also there is an important emergency provision in the widely used standard specification for pipe, A 53, to give emergency coverage for water well pipe.

Heavy Steel Forging Activities:

Tremendous demands for various types of heavy forgings, ship shafts, turbine parts, chemical equipment and so forth, caused particularly by naval and shipbuilding demands brought rapidly to the forefront in May and June of 1942 the urgent desirability of standardizing specification requirements—the main objective being to stimulate increased production both in the ingot phase and through the forging and finishing processes. With the National Emergency Steel Specification (NESS) project in force, the Administrative Committee agreed to the development of a Technical Advisory Committee on Heavy Forgings, details of which have been announced in previous Bulletins. C. J. Boyle, General Electric Co., and other outstanding metallurgists, practically all of whom are active members of the Society, have participated in this work. There follows a list of the new ASTM emergency specifications:

- Alloy-Steel Non-Magnetic Coil Retaining Rings for Turbine Generators
- Carbon-Steel and Alloy-Steel Magnetic Retaining Rings for Turbine Generators
- Carbon-Steel and Alloy-Steel Turbine Bucket Wheels
- Carbon-Steel and Alloy-Steel Turbine Rotors and Shafts
- Carbon-Steel and Alloy-Steel Turbine Generator Rotors and Shafts
- Carbon-Steel Ring Forgings for Main Reduction Gears
- Carbon-Steel and Alloy-Steel Pinion Forgings for Main Reduction Gears

Each of these specifications pertaining to various turbine and generator parts raised numerous questions which were reconciled through the close cooperation of consumers and producers on the committee. One of the perplexing problems was to simplify chemical compositions. There were quite a large number of grades in use and of course to expedite tonnage and simplify steel making, forging and fabricating problems a limited number would be desirable. This achievement in the specifications represents an outstanding piece of work. In order most effectively to achieve conservation of critical elements, chemical ranges are set up for some of the products—*exact* figures subject to agreement between producer and consumer. These turbine parts so extremely important in ships and other work in many cases need considerable alloying elements to guarantee against excessive wear to produce the required combination of strength and ductility, and if a list were developed of steel products which require alloy elements, at the expense of alloys in other materials, these products would loom high in the list.

All of the foregoing specifications were developed in sections on turbine and generator forgings.

General Forgings.—Another section of the main TAC, working on general forgings, decided the most constructive recommendations would be to provide for a use of existing standards by recommending emergency alternate provisions. The two A.S.T.M. specifications involved were Carbon-Steel Forgings for General Industrial Use (A 235 – 42) and Alloy-Steel Forgings for General Industrial Use (A 237 – 42), the emergency provisions providing for heavier forgings and taking care of other necessary details, these provisions being printed in full in the back portion of this Bulletin.

Water Well Pipe:

Among the various recommendations made by the National Emergency Steel Technical Advisory Committee on Tubular Products headed by T. G. Stitt, Pittsburgh Steel Co., some of which are now awaiting final action by the Administrative Committee, there is one pertaining to water well pipe to be covered by A.S.T.M. Specifications A 53 for Steel Pipe and A 72 for Wrought Iron Pipe. However, there was one exception, Grade C, which grade is not covered by any specification except in the A.I.S.I. Manual, No. 18. Consideration of this matter resulted in decision to set up an emergency alternate provision in A 53 which would thus provide standard requirements and accordingly these provisions have now become effective as detailed in the back portion of this Bulletin. This provision was approved in Subcommittee IX of Committee A-1.

Non-Ferrous Metals and Alloys:

Two of the important specifications in the charge of Committee B-2 on Non-Ferrous Metals and Alloys are those covering White Metal Bearing Alloys (B 23 – 26) and Soft Solder Metal (B 32 – 40 T). Emergency alternate provisions were previously issued involving these specifications and recently additional modifications have been approved.

In the bearing metal emergency provisions, minor changes are recommended in only one of the Emergency Alloy Grades No. 15. These modifications are proposed as a result of experience with this alternate alloy.

With reference to EA – B 32, extensive changes are being made in the list of emergency alternate solder metal compositions. In the tin-lead and tin-lead-antimony solders, Grade A is to be abolished since the tolerances in composition are considered unduly restrictive for use during the National Emergency. Further experience with the silver-lead solders has resulted in the development of new alloys and the revision recommended includes seven compositions which are presented as replacements of the eight alloys covered in the earlier edition of EA – B 32. There is included in the appendix corresponding information on the properties of these soft solder metals and also certain information on their uses and applications. (See back of this BULLETIN for details.)

Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors:

From the new emergency alternate provisions published in the back portion of this BULLETIN it will be noted that one of these involves the Standard Specifications for Concentric-Lay-Stranded Copper Cable, Hard, Medium-Hard, or Soft (B 8 – 41) by which the scope is modified to permit use of lead or lead alloy coated wires and the list of specifications for copper wire that may be used will include the Emergency Specifications ES – 1a covering lead-coated and lead-alloy coated copper wire for electrical purposes.

Committee B-5 on Copper and Copper Alloys, Cast and Wrought:

One of the important 1942 developments in the field of copper was the agreement in Committee B-2 on Emergency Specifications ES – 7 covering fire-refined copper for wrought products and alloys. There has just been approved emergency alternate provisions in 23 specifications by which the material conforming to ES – 7 will be considered approved as an alternate grade for use under the terms of the following specifications:

B 12 – 42	(Copper Bars for Locomotive Staybolts)
B 19 – 42 T	(Cartridge Brass Sheet, Strip, etc.)
B 22 – 42 T	(Bronze Castings for Turntables and Movable Bridges)
B 36 – 42 T	(Brass Sheet and Strip)
B 100 – 40	(Rolled Copper-Alloy Bearing Plates)
B 103 – 42	(Phosphor Bronze Sheet and Strip)
B 111 – 42	(Copper and Copper-Alloy Tubes)
B 121 – 42 T	(Leaded Brass Sheet and Strip)
B 122 – 42 T	(Copper-Nickel-Zinc and Copper-Nickel Alloy Sheet and Strip)
B 124 – 42 T	(Copper-Base Alloy Forging Rods, etc.)
B 129 – 42 T	(Cartridge Brass Cartridge Case Cups)
B 130 – 42 T	(Gilding Metal Sheet and Strip)
B 131 – 42 T	(Gilding Metal Bullet Jacket Cups)
B 133 – 42 T	(Copper Rods, Bars, and Shapes)*
B 134 – 42 T	(Brass Wire)
B 135 – 42 T	(Miscellaneous Brass Tubes)
B 139 – 42 T	(Phosphor Bronze Rods, Bars, etc.)
B 148 – 42 T	(Aluminum-Bronze Sand Castings)
B 151 – 42 T	(Copper-Nickel-Zinc Alloy Rod and Wire)
B 152 – 41 T	(Copper Sheet, Strip, and Plate)*
B 159 – 42 T	(Phosphor Bronze Wire)
B 169 – 41 T	(Aluminum Bronze Sheet and Strip)
B 171 – 42 T	(Copper-Alloy Condenser Tube Plates)

* There is a qualification in connection with two of the specifications, B 133 and B 152, excepting the use of fire-refined copper for material to be used for electrical purposes.

Committee D-11 on Rubber Products:

In order that the Standard Specifications for Friction Tape for General Use for Electrical Purposes (D 69 – 38) and Rubber Insulating Tape (D 119 – 38) can be used and be in line with orders issued by the War Production Board which prohibits the use of crude rubber or latex in friction tape or limit the new rubber in rubber insulating tape to a maximum of 7 lb. new rubber and 21 lb. of reclaim per 27,000 sq. in. of 0.027 gage tape, Committee D-11 on Rubber Products has developed emergency alternate provisions as detailed in the back portion of this BULLETIN. Also the modifications bring the specifications in line with recently adopted changes in Federal Specifications E-HH-T-101a. These pink slips, which should be of great help in connection with procurement problems, will be furnished with Part III of the 1942 Book of Standards. It is plannned also that they will be included in the 1942 compilation of "Standards on Rubber Products" scheduled for publication early in 1943.

Insulating Wire and Cable.—The emergency provision published in this BULLETIN applying to the Standard Specifications for Insulated Wire and Cable: Heat-Resisting Rubber Compound (D 469 – 41) are intended primarily to conserve rubber and provide an agreed-on specification for insulation which may be operated at copper temperatures above 60 C. The requirements are acceptable to a number of organizations whose inspection or activities involve a use of the material and since there has been no other standard available, the new provisions will serve an important need and can be referred to in restrictive orders of the War Production Board and can be made available to commercial organizations and Underwriters Laboratories.

All of the emergency alternate provisions (pink slips) described in the preceding article are furnished with the Book of Standards with the exception of EA – A 235, EA – A 237 and EA – A 53 just approved. The new emergency heavy forging specifications are now being printed and will be furnished to members on request. These were not included in Part I of the 1942 Book of Standards.

Publication Shipments

VARIOUS MEMBERS of the Headquarters Staff who have to contend with various foreign, Government, and company practices with respect to the billing and shipment of numerous publications could write exhaustively on the subject and with vigor. Of course, many of the A.S.T.M. books going to foreign lands need to be specially packed and our own Government requires on certain purchases that numerous precautions be taken to insure receipt in good condition. For example, the recent shipment of a set of the Book of Standards in a wooden box, "with no part less than 1 in. thick and no knots or checks in any of the lumber. Two envelopes, containing packing lists, in waterproof containers to be securely affixed to different sides of the box. Symbol numbers for the shipment in waterproof ink or paint on two opposite sides of the box, the books themselves to be wrapped in waterproof packing material." This shipment is going to New York City . . . but we have strong suspicion the climate of that metropolis is not sufficiently hazardous to require such elaborate precautions. We hope the books may do considerable good wherever they may be going.

A New Recording Viscometer for Paint Consistency Measurements*

By C. R. Wicker[1] and J. A. Geddes[1]

SYNOPSIS

A new recording viscometer, combining the principles of the modified Stormer and the McMichael instruments, is described. A cylindrical container is rotated at constant speed, the liquid within imparting torque to a paddle connected with a spring. A lever arm records the consistency upon a moving chart. Speed of rotation can be varied from 30 to 285 rpm.

The instrument has been calibrated in grams per 200 rpm. on the modified Stormer, in Krebs units, and in absolute units for viscous liquids. Calibrations are essentially straight-line functions. Using one spring only, the viscometer covers a range of 100 to 950 Stormer grams per 200 rpm., 60 to 135 Krebs units, or 5 to 45 poises, which includes the practical range of paint consistencies. Springs of different characteristics can be used to extend the range.

Stress-strain curves obtained on this instrument are similar to comparable data from modified Stormer viscometer data. Unlike the Stormer, however, the recording viscometer can be used to obtain a continuous record of consistency. It is therefore possible not only to measure thixotropic and rheopectic paints, but also to follow the thickening of water sensitive systems, effect of bodying agents, and similar phenomena of interest to the paint chemist.

Less skill and experience are required to operate the recording viscometer, and a series of determinations can be made somewhat more rapidly than on the modified Stormer. The new viscometer therefore appears suited for control work as well as research consistency measurements.

THE CONSISTENCY of paint systems is an important physical property, because of its relation to brushing, flow, and settling. Since most paints cannot be classed as truly viscous materials, it is customary to measure consistency by means of instruments which can subject a paint to different rates of shear. A simple viscometer of the Ostwald type, for example, is not suitable. Instruments which have been employed more or less successfully by paint chemists include the Ford cup,[2] Parlin cup,[3] Gardner-Parks Mobilometer,[4] and the modified Stormer viscometer.[5] The cup types are used at only one rate of shear, and therefore are no more suitable for expressing paint consistency than is the Ostwald capillary tube instrument. The Gardner and Stormer instruments, however, can be used at widely different shear rates, to furnish valuable information on the rheology of paint systems. Of these instruments, the Stormer is somewhat more easily cleaned and operated, and is meeting with increasingly favorable consideration from paint technicians.

There are numerous consistency problems which cannot be solved even by these variable shear instruments, however. Among these may be mentioned the phenomena of thixotropy and rheopexy (change of consistency upon agitation). The effect of time upon consistency obviously cannot be determined by the usual methods. Also, the effect of addition agents upon consistency can only be high spotted by use of available practical instruments.

For this reason, it was considered advisable to design a viscometer which would retain the desirable features of the commercial instruments previously mentioned, and also would permit continuous recording of consistency, thus extending its range of usefulness for paint measurements. Such an instrument was designed by the senior author and developed by the Brabender Corp. in accordance with our requirements.

Description of the Instrument

The instrument in its present form is shown in Fig. 1. It comprises a circular "table" which is rotated at a constant speed, to which a pint can may be fastened by means

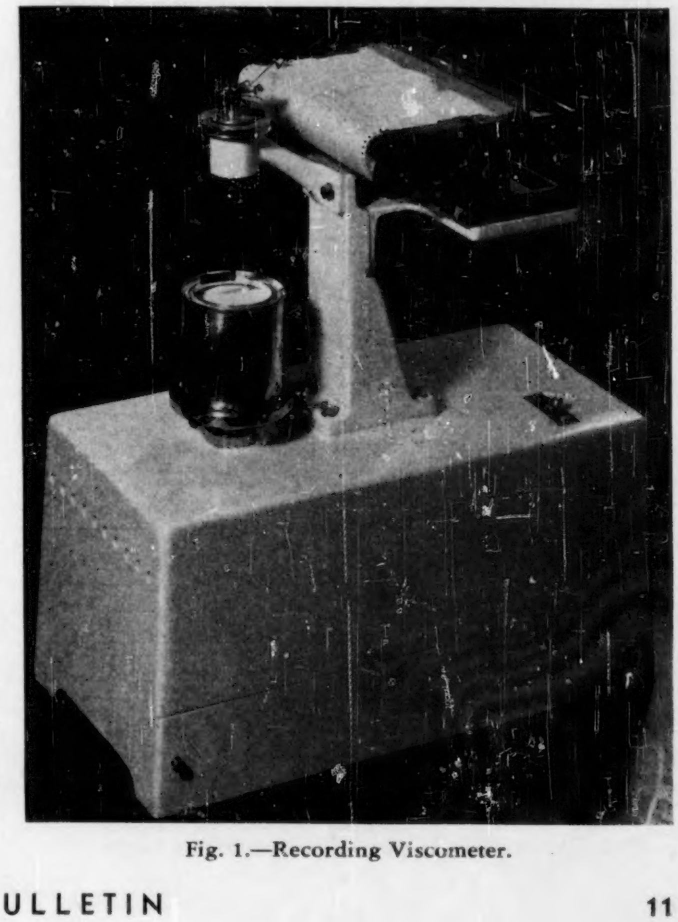


Fig. 1.—Recording Viscometer.

NOTE—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

*Presented at the Forty-fifth Annual Meeting, Am. Soc. Testing Mats., Atlantic City, N.J., June 22–26, 1942.

[1] Research Chemists, Pigments Dept., E. I. du Pont de Nemours and Co., Inc., Newport, Del.

[2] H. A. Gardner, "Physical and Chemical Examination of Paints, Varnishes, Lacquers, and Colors," Ninth Edition, Second Printing, p. 224 (1940).

[3] H. A. Gardner, "Physical and Chemical Examination of Paints, Varnishes, Lacquers, and Colors," Fifth Edition, pp. 259–261 (1930).

[4] H. A. Gardner and H. C. Parks, "Consistency of Paints, Enamels, and Pigmented Lacquers," *Circular No. 265*, Paint Mfrs. Assn., pp. 414–428 (1926).

[5] J. H. Perry, "Chemical Engineer's Handbook," Second Edition, p. 1535, McGraw-Hill Book Co., New York, N. Y. (1941).

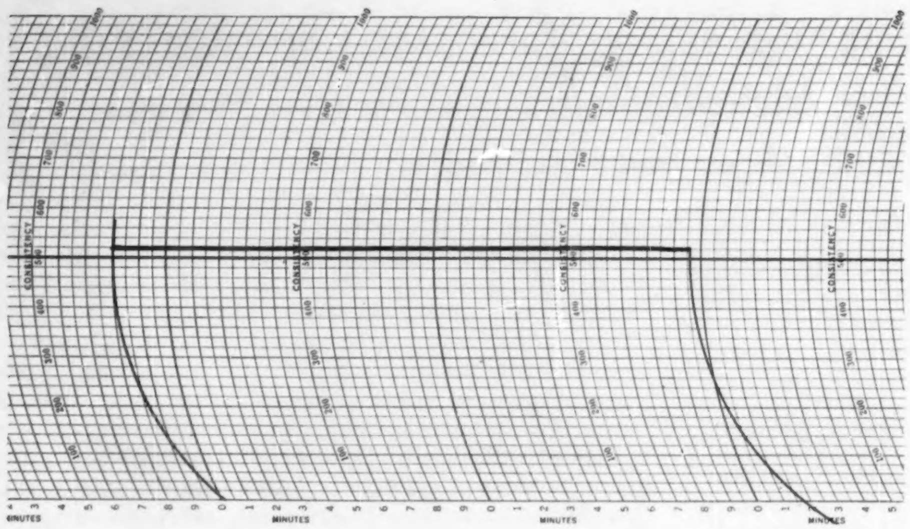


Fig. 2.—Normal Paint at 200 rpm.

of set screws. A "submerged" paddle[6] of the type used on the modified Stormer viscometer is pivoted coaxially with the table, which can be raised or lowered so as to immerse the paddle to the proper depth in the liquid being measured. The submerged paddle is marked to indicate this depth. The liquid in the rotating can imparts a moment tending to rotate the paddle, the moment being measured by the angular displacement of a spring. A lever arm connected with this spring is provided with an inking mechanism, which draws a continuous line upon a chart moving under the pen at a constant speed. By this means a continuous record of consistency can be obtained over a long period of time.

One end of the spring which opposes the torque is connected to the pivoted paddle shaft by means of a small arm, while the other end is fastened to the frame. Set screws are likewise used for fastening this spring, so that it is easily replaceable if springs of different sensitivity are needed to extend the range of measurement. The paddle shaft is provided with stops which prevent damage to the spring through imposition of excessive torque. The paddle itself is also removable, in order that different types may be inserted for special purposes.

[6] R. H. Sawyer, "Development of a Consistency Test," Abstracted in ASTM Bulletin, January, 1940, No. 102, p. 18.

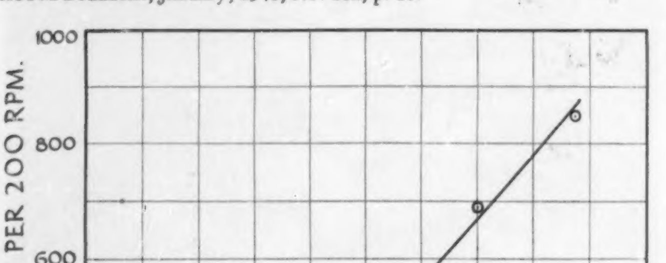


Fig. 3.—Recording Viscometer Calibration Curve.

The instrument is built upon a rectangular base casting, to which is bolted a casting which supports the recording mechanism and the pivoted paddle and spring. Inside the base casting, a constant speed a-c. motor is housed, whose shaft is extended down to permit the attachment of a set of four pulleys (cast as one unit). A V-belt connects these pulleys with another set of pulleys tapering in the opposite direction, which drive the shaft on which the turntable is mounted.

By simply changing the position of the V-belt, it is possible to rotate the table at speeds of 100, 140, 200, and 285 rpm. If lower speeds are desired, the pulleys can be removed from the shafts and positions reversed, whereby driving speeds of 80, 60, 42, and 30 rpm. can be obtained.

The recording mechanism is likewise driven by a constant speed motor. The chart ordinarily moves at a speed of 2 cm. per min. If a long record of consistency is desired, it is possible to reduce the speed by a factor of 1:4 simply by changing the position of two gears in the front of the instrument.

Method of Operation

A spring suitable for the consistency range under consideration is fastened to the frame and to the pivoted paddle shaft, so that the lever arm containing the inking pen lies upon the zero line of the chart.

A pint can of material to be measured is placed upon the turntable and fastened by means of three screws. The table is then raised until the liquid in the can is level with the mark on the submerged paddle and is fixed in this position by tightening a set screw through the collar at the base. The V-belt is placed upon the pulleys so as to give the desired speed of revolution, and the motor is started.

The first impulse of the rotation will cause the paddle, and therefore the recording arm, to swing somewhat beyond the equilibrium position, but this is corrected in a few seconds. Assuming no appreciable thixotropic effects, the consistency as recorded on the chart will level

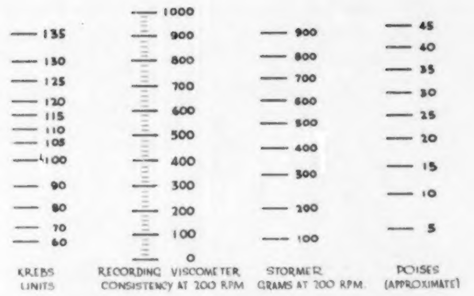


Fig. 4.—Calibration of Recording Viscometer.

to its final value in perhaps 1 min. or less, and long-continued measurement will not change this value unless the temperature of the liquid is altered. A typical chart obtained with a liquid whose consistency is independent of time or previous history is shown in Fig. 2. It should be noted that the chart paper available during this study was not designed for the recording viscometer, and therefore the arc of the pen does not correspond to the constant time arcs on the chart. Also, 2 min. on the chart represents only 1 min. of elapsed time. Suitable charts are now being prepared for use with the instrument.

Calibration

Recording viscometer consistencies were obtained on a large number of paints as well as on several viscous oils, using 200-rpm. speeds. The same materials were then measured on the modified Stormer viscometer, and the weights required to give 200 rpm. were obtained according to the A.S.T.M. Standard Method of Test for Consistency of Enamel Type Paints (D 562 - 41).[7] Upon plotting these data against each other, it was found possible to draw a smooth curve which expresses the relationship between recording viscometer chart units and Stormer grams per 200 rpm. (Fig. 3). This relation is plotted to scale in Fig. 4.

From the Stormer grams per 200 rpm., Krebs units can be obtained,[5,8] and these values were plotted against recording viscometer chart units in Fig. 4. Also, by the application of a correction for energy losses,[8] it is possible to calculate the absolute viscosity in poises from Stormer grams per 200 rpm. Such values (approximate because of assumption of 1.0 for density of all liquids used) are likewise plotted on Fig. 4. In order to check the validity of this calibration, the viscosity of four oils was measured on both the modified Stormer and the recording viscometer. The results listed in Table I show that the calibration is sufficiently accurate to indicate the consistency range available using a certain spring.

Consideration of Fig. 4 will show that the recording viscometer, using such a spring, covers a sufficiently wide consistency range to make it applicable to most paint problems. Also, the variation of torque (or chart units) with consistency as measured by other methods is sufficiently close to linearity to make the new instrument suitable over the entire range covered.

TABLE I.—RECORDING VISCOMETER CONSISTENCY OF VISCOUS LIQUIDS.

Oil	Calculated Stormer Viscosity, poises	Recording Viscometer Chart Units	Viscosity from Calibration Chart, poises
A......	6.1	180	7
B......	9.8	280	10
C......	11.7	320	12
D......	40.9	880	41

Determination of Consistency at Various Rates of Shear

Having shown that the new recording viscometer can be calibrated at 200 rpm. in terms of various other types

[7] 1941 Supplement to Book of A.S.T.M. Standards, Part II, p. 237.

[8] J. A. Geddes and D. H. Dawson, "Calculation of Viscosity from Stormer Viscometer Data," *Industrial and Engineering Chemistry*, Vol. 34, p. 163 (1942).

TABLE II.—DESCRIPTION OF PAINTS USED IN CONSISTENCY TESTS.

Paint		Pigment	Per Cent by Weight	Vehicle	Other Materials
Group *A*	No. 1	Rutile titanium dioxide	27	Long oil modified alkyd	
	No. 2	Rutile titanium dioxide	23	Long oil modified alkyd	Mineral spirits
	No. 3	Titanium-calcium pigment	63.5	Oil modified ester gum maleic type	
	No. 4	Titanium-calcium pigment	55	Oil modified ester gum maleic type	
	No. 5	Titanium-calcium pigment	63	Heavy kettle bodied linseed oil	Mineral spirits
	No. 6	Titanium-calcium pigment	60	Heavy kettle bodied linseed oil	Mineral spirits
	No. 7	Titanium-magnesium pigment 35% Leaded zinc oxide	35 35	Alkali refined linseed oil	
	No. 8	Titanium-magnesium pigment 35% Leaded zinc oxide	32 32	Alkali refined linseed oil	
Group *B*	No. 9	Anatase titanium dioxide	29	Medium oil maleic type	Calcium linoleate pulp
	No. 10	Anatase titanium dioxide	29	Medium oil maleic type	
	No. 11	Anatase titanium dioxide	25	Long oil modified alkyd	Mineral spirits
	No. 12	Titanium-calcium pigment Whiting	57 9	Bodied linseed oil	Zinc resinate Calcium linoleate pulp Aluminum stearate
	No. 13	Titanium-calcium pigment Whiting	57 9	Bodied linseed oil	Zinc resinate Calcium linoleate pulp Aluminum stearate
	No. 14	High strength lithopone Anatase titanium dioxide Whiting	53 8 8	Bodied linseed oil	Zinc resinate Calcium linoleate pulp Aluminum stearate
	No. 15	Titanium-calcium pigment Whiting	57 9	Bodied linseed oil	Zinc resinate Calcium linoleate pulp Aluminum stearate
	No. 16	Titanium-calcium pigment Fibrous talc	50 12.5	100-gal. limed rosin	
	No. 17	Titanium-calcium pigment Fibrous talc	50 12.5	½—100-gal. limed rosin ½—ester gum	
	No. 18	Rutile titanium dioxide	31	Urea-alkyd	
	No. 19	Rutile titanium dioxide 35% Leaded zinc oxide Fibrous talc	7.4 30 23	Alkali refined linseed oil	
	No. 20	Anatase titanium dioxide 35% Leaded zinc oxide Fibrous talc	9 30 21	Alkali refined linseed oil	
	No. 21	Anatase titanium dioxide	32	Long oil modified alkyd	(Unground)
	No. 22	Nonchalking titanium dioxide 35% Leaded zinc oxide Fibrous talc	11 34 25	Raw linseed oil—bodied linseed oil	

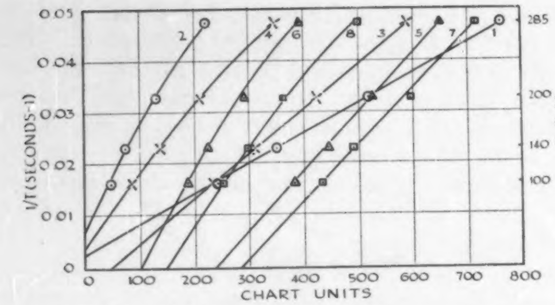


Fig. 5.—Recording Viscometer Consistency Curves.

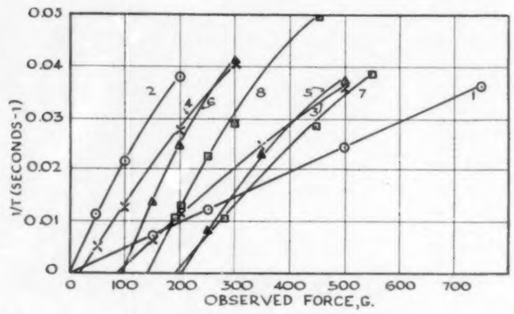


Fig. 8.—Modified Stormer Consistency Curves.

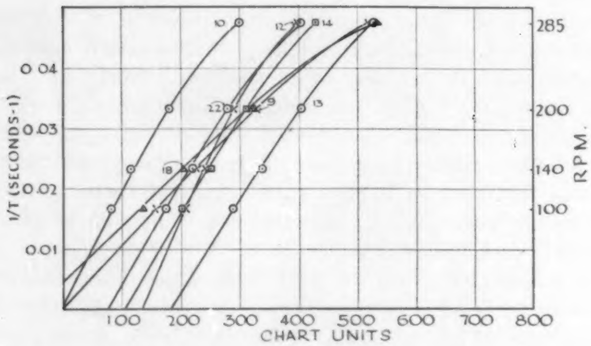


Fig. 6.—Recording Viscometer Consistency Curves.

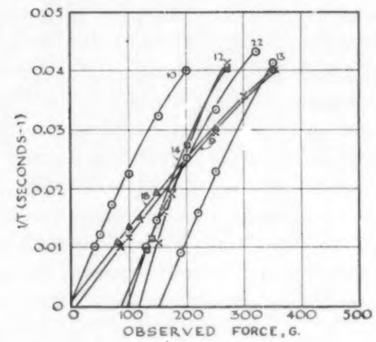


Fig. 9.—Modified Stormer Consistency Curves.

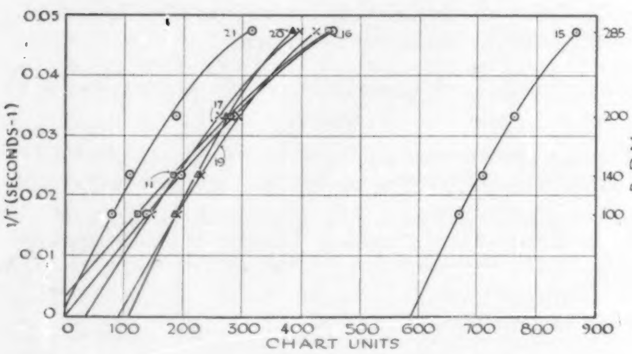


Fig. 7.—Recording Viscometer Consistency Curves.

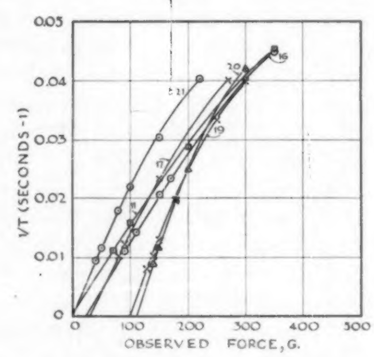


Fig. 10.—Modified Stormer Consistency Curves.

of units, it was then necessary to determine whether similar relations would be found at different rates of shear and whether the instrument could be used to plot stress-strain curves which would provide information concerning flow properties of paint systems. Twenty-two paints were chosen for this purpose. Eight of these (group *A*) consisted of heavy and medium (brushing) consistency levels in four widely different coating types—enamel, interior gloss, interior flat, and outside house paint. The remaining fourteen (group *B*) were chosen at random throughout our laboratory and represent several additional paint types. These paints are described in Table II, while the consistency data obtained on the recording viscometer at various speeds are plotted in Figs. 5 to 7. In almost every case, definite curvature toward the torque or "chart unit" axis is noted, particularly at high rates of shear. This is ascribed to greater loss of energy at higher speeds, probably because of the introduction of turbulent flow, just as has been previously noted on the modified Stormer viscometer.[8]

For comparative purposes, the same paints were run on the modified Stormer viscometer at several different rates of shear. The results are plotted in Figs. 8 to 10 and can be compared directly with corresponding recorder values. It is obvious that the Stormer and recorder curves are al-

TABLE III.—COMPARISON OF MODIFIED STORMER AND RECORDING VISCOMETER CONSISTENCIES.

Paint	Recording Viscometer		Modified Stormer Viscometer	
	Yield Value	Mobility $\times 10^4$	Yield Value	Mobility $\times 10^4$
No. 1	(0)	0.59	0	0.49
No. 2	(0)	2.30	0	1.96
No. 3	45	0.87	80	0.90
No. 4	(0)	1.51	20	1.51
No. 5	255	1.21	200	1.41
No. 6	105	1.85	95	2.22
No. 7	295	1.11	180	1.07
No. 8	160	1.67	140	1.87
No. 9	0	1.02	10	1.22
No. 10	0	1.91	0	2.14
No. 11	(0)	1.10	(0)	1.39
No. 12	135	2.16	115	2.97
No. 13	185	1.52	155	2.23
No. 14	100	1.60	100	2.46
No. 15	590	1.91	(Could not measure)	
No. 16	0	1.16	25	1.55
No. 17	40	1.49	30	1.85
No. 18	(0)	0.98	0	1.19
No. 19	95	1.72	100	2.22
No. 20	110	2.03	110	2.56
No. 21	(0)	1.81	0	2.00
No. 22	80	1.63	90	2.14

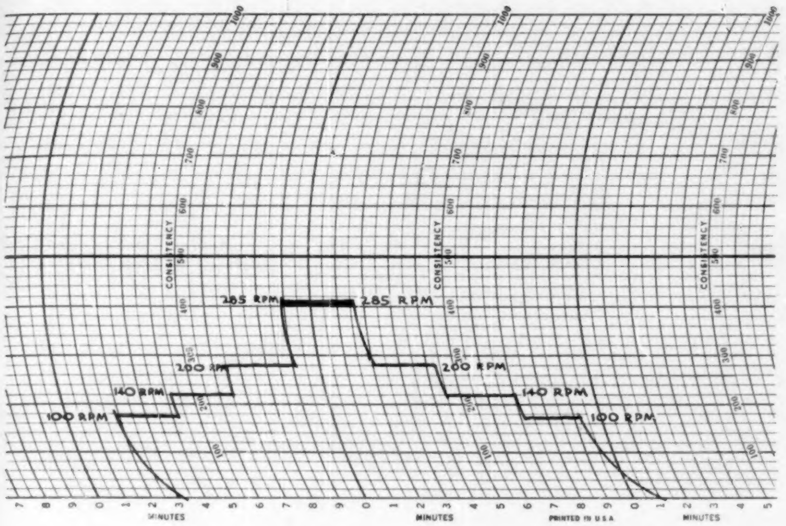


Fig. 11.—Normal Paint at Various Speeds.

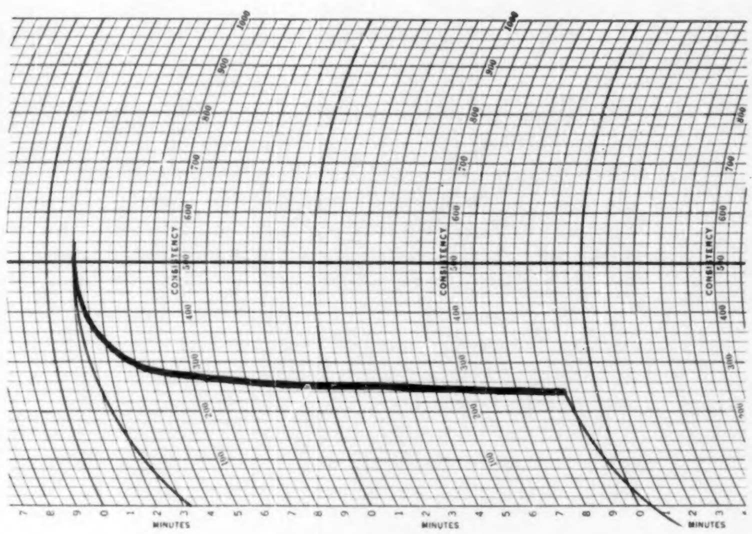


Fig. 12.—Thixotropic Paint at 100 rpm.

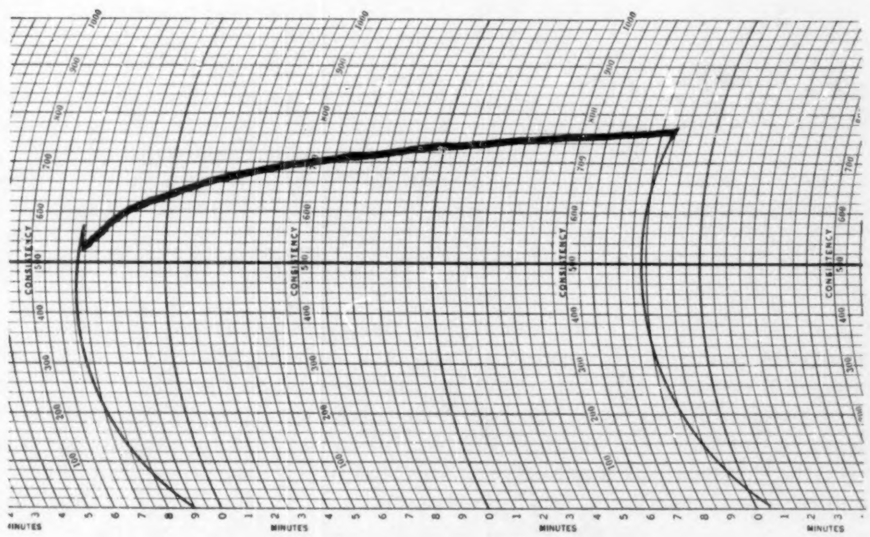


Fig. 13.—Rheopectic Paint at 200 rpm.

most identical, which further proves the utility of the new instrument for paint consistency determinations.

To illustrate the correlation more clearly "yield values" (intercept on the chart unit axis) and "mobilities" (slope of the curve from 200 rpm. to zero speed) have been calculated and compared with yield values and mobilities similarly calculated from Stormer data, in Table III. These results agree very well, qualitatively at least, and, in addition, the numerical values are almost identical. In other words, the recording viscometer in its present form could be used as a direct replacement for the modified Stormer, without requiring reorientation of the operator's thinking in terms of consistency. If even closer agreement is required, the chart could be printed in a scale reading Stormer grams per 200 rpm. directly, for example, rather than in its present linear scale.

Figure 11 indicates the type of plot obtained on a normal paint at various speeds. This shows the constancy of torque at a given speed, regardless of whether this speed is approached from the high or low side.

Consistency—Time Relations

One of the principal advantages of the recording instrument is the ability to provide a continuous record of the consistency of a material over a period of time. Conditions under which this feature is particularly useful include:

1. Bodying of water-sensitive pigments.
2. Change in structure of paints by agitation:
   (*a*) Thixotropy—decrease in consistency.
   (*b*) Rheopexy—increase in consistency.
3. Effect of added materials, including bodying oils and thinners.

To illustrate the manner in which these effects might show up on the recording viscometer, three charts are presented. Figure 12 shows the decrease in consistency of a lithopone-low acid vacuum bodied linseed oil upon agitation at 100 rpm. (thixotropy). The initial consistency decrease is seen to be much larger than that observed for a normal paint (Fig. 2), and the equilibrium consistency value is approached more slowly. The modified Stormer and most other commercially used viscometers could not be used on a paint of this type, since continuous agitation is required to reach an equilibrium consistency. Measurements on these instruments would be erratic, and the values ob-

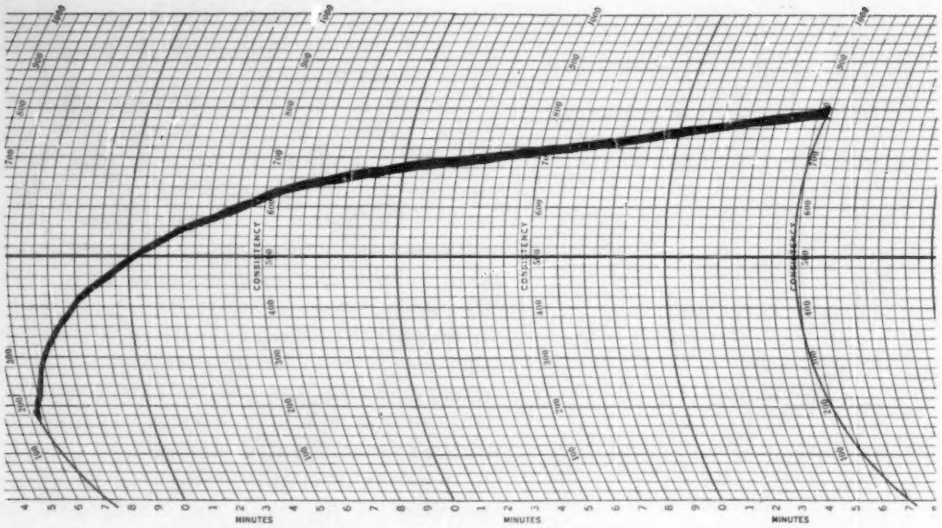


Fig. 14.—Effect of Soap Solution in Paint at 200 rpm.

tained would depend upon the time elapsed between successive observations.

Figure 13 illustrates the somewhat less familiar phenomenon of rheopexy. A titanium dioxide-calcium carbonate-low acid number linseed oil was tested at 200 rpm. The consistency was found to increase very appreciably, and was still rising somewhat after 11-min. agitation.

Figure 14 shows the effect of 1 per cent soap solution in a titanium dioxide-calcium carbonate-long oil ester gum system. The soap solution was stirred in by hand for approximately 5 min., and the paint was then placed on the recording viscometer. The consistency at 200 rpm. is seen to rise very rapidly from the low initial value, and is still increasing after 15 min., although the rate of increase has slowed appreciably. This chart, of course can be continued until equilibrium consistency is reached.

TABLE IV.—TIME REQUIRED FOR TEN CONSISTENCY MEASUREMENTS.

Number of Observers	Average Time, min.	
	Modified Stormer Viscometer	Recording Viscometer
3	Skilled.............. 34	Unskilled........... 27
1	Unskilled........... 75	Unskilled........... 35
4	Average............ 44	Average............ 29

Speed of Operation

Laboratories which make a large number of consistency determinations per day will be interested in the relative times required for such measurements on the new recording and on the modified Stormer viscometer. To check this point, observations were made on ten paints, by four observers, three of whom were skilled in the use of the modified Stormer, while none had any experience with the recording viscometer. The times required to make these consistency determinations (Stormer grams per 200 rpm. or Krebs units in one case, recording viscometer chart units in the other) were averaged as shown in Table IV.

It is evident not only that an appreciable saving in time can be obtained on the recording viscometer, but also that less skill is needed on the part of the operator.

DISCUSSION

MR. EUGENE C. BINGHAM[1] (*presented in written form*).—There is ample opportunity for a viscometer having: (1) variable rate of shear, (2) automatic and continuous recording, giving information as to thixotropy, (3) convenience of use, and (4) the possible expression of results in absolute rather than empirical units.

The authors have made progress in all of these directions, and it is hoped that they will be able to demonstrate the reliability of the instrument. I hope that it may help to point out that the Stormer viscometer, to my personal knowledge, gives a linear curve with a viscous liquid at various rates of shear, except at very small or very large shearing stresses. Several of the paints showed no yield value and therefore appear to have had the properties of viscous liquids, yet all of them show marked curvature except No. 1. The explanation of this curvature is needed and the explanation for the Stormer instrument may also apply to the recording instrument.

It is difficult to verify the authors' statement that "the numerical values are almost identical" for the two instruments, because the abscissas for the figures of the Stormer are in Observed Force, g. while those of the recorder are in "chart units." In fact, the curves appear not to be identical because on the recorder paints Nos. 1, 2, 4, 11, 18, and 21 all show a *negative* yield value. If this is an impossibility, its apparent occurrence needs explanation. It is to be noted that the Stormer instrument gives evidence in support of the theory that a negative yield value cannot occur.

While the authors have not claimed a high degree of precision, it is important to know what precision can be attained and what precautions are necessary. We note that in the calibration, the deviation, for the most fluid oil, A, from the Stormer value, used for calibration, was 14.7 per cent. This might indicate that the recorder gives too high viscosities with the more fluid liquids, but the following facts make this conclusion improbable. The authors have studied 7 paints which showed little or

[1] Professor of Chemistry, Lafayette College, Easton, Pa.

no yield value and must therefore be supposed to behave like true fluids. Paint No. 1 shows the lowest mobility and No. 2 the highest mobility, yet the recorder gives roughly 20 per cent higher mobility than the Stormer for both. The paints of intermediate mobility, on the other hand, show lower mobility with the recorder. These facts are confusing, but since the deviations average over 10 per cent, can we regard them as negligible?

With the 11 paints having an appreciable yield value, the Stormer mobility is higher than that of the recorder in all but one case where they are the same. The average deviation is 28 per cent. The yield values are lower in 7 paints, the same in 2 and higher in 2, with an average deviation of 20 per cent. This analysis indicates that if the Stormer mobility is higher and the yield value lower, we can hardly avoid the conclusion that the recorder consistency is higher.

In connection with points that need to be explained, information should be given as to temperature control, the maintenance of a level surface at different rates of shear, the importance of the dimensions of the container and of its centering on the table, the effect of friction in the recording apparatus, and finally a correction for the weight of the pan on which the weights rest in the Stormer instrument.

Mr. H. A. Nelson.[2]—I am interested in the point that Mr. Bingham brought out about the level of the paint surface. Since the can is revolved, there would be some centrifugal effect if it attains an appreciable speed.

Mr. D. H. Dawson.[3]—At higher speeds there is some change. However, it will be noticed that the authors use a submerged type of paddle, and consequently the errors introduced from the difference in level of the paint are small. Obviously, if the fork type of paddle, or cylinder, is used, I think the rates of rotation and consistencies might have to be limited.

Mr. R. T. Webster.[4]—My comment is in reference to Fig. 3 of the paper, showing the recording viscometer calibration curve. From Mr. Bingham's remarks I would infer that the curve should be linear and intersect the axis at the zero point. I am wondering whether there might be an engineering explanation for the nonlinearity of this calibration curve.

Mr. Dawson.—The Stormer-recorder calibration curve (Fig. 3) departs from linearity at low consistencies. This is probably due to the differences in friction in the mechanisms of the instruments.

Mr. J. W. Stillman[5] (*by letter*).—In our opinion Messrs. Wicker and Geddes have made a very useful contribution to the testing of paints. It is evident from the data which they present that the results obtained with their new instrument correlate very satisfactorily with the results obtained by the modified Stormer instrument which has been in regular use. The fact that the instrument is equipped with a recorder permits its use for continuous measurements which bring out the unusual properties of the paint and permit a study of the effects of various addition agents.

[2] Assistant to General Manager, Technical Dept., The New Jersey Zinc Co. (of Pa.), Palmerton, Pa.

[3] Research Division Head, Pigments Dept., E. I. du Pont de Nemours and Co., Inc., Newport, Del.

[4] Engineer, Quality Control, Western Electric Co., Inc., Kearny, N. J.

[5] Chemical Dept., Experimental Station, E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.

Messrs. C. R. Wicker[6] and J. A. Geddes[6] (*authors' closure, by letter*).—Mr. Bingham's experience that the Stormer viscometer gives a linear curve with viscous liquids is contrary to that of the authors at least as far as the Stormer modified for use with paint systems,[7] as it was used in this work, is concerned. For additional data showing nonlinear curves with viscous liquids with the modified Stormer, reference should be made to the work of Geddes and Dawson[8] and by the New York Paint and Varnish Production Club Technical Committee[9]; for data on nonlinear curves with nonviscous liquids to work described.[9,10] This is discussed particularly by Geddes and Dawson,[8] who propose a correction for kinetic energy losses, application of which eliminates the conca y both with viscous liquids[8] and with most nonviscous liquids tested.[9]

In this case, Mr. Bingham may refer to the unmodified Stormer, where kinetic energy losses would be less, and linear stress-strain curves would be expected. It is believed that the explanation of the nonlinear curves obtained with the recording viscometer lies also in kinetic energy losses. Correction terms such as those applied to the modified Stormer by Geddes and Dawson,[8] however, failed to give linearity.

Mr. Bingham asks, secondly, for the explanation of the "negative yield values" indicated by the curves from the recording viscometer. These result, in all probability, from the extrapolation from 100 rpm. It is believed, although it has not been proved, that exploration at lower rates of shear would result in more marked curvature, but the absence of "negative yield values."

Intercomparison of data from the two instruments can be made by observing that the abscissa of the modified Stormer curves are "Observed Force, grams," and by the use of Fig. 3, which relates the Stormer force in grams at 200 rpm. with the arbitrary "Chart Units" or "recorder consistency" of the recording viscometer.

Regarding the precision obtainable with this instrument, it has been found that modified Stormer consistency at 200 rpm., as defined in A.S.T.M. Method D 562, can be determined to ±5 per cent by the use of the recording viscometer and the calibration curve in Fig. 3. Modified Stormer consistency can be determined in the "Krebs Units"[8,11] utilized in many Government paint specifications to ±2 K.U. This precision is adequate for most practical purposes, and is of the same order as the reproducibility with different Stormer instruments. Greater or less precision might result from the selection of different springs, particularly by the use of a num-

[6] Research Chemists, Pigments Dept., E. I. du Pont de Nemours and Co., Inc., Newport, Del.

[7] Standard Method of Test for Consistency of Enamel-Type Paints (D 562 - 41), 1941 Supplement to Book of A.S.T.M. Standards, Part II, p. 237.

[8] J. A. Geddes and D. H. Dawson, "Calculation of Viscosity from Stormer Viscometer Data," *Industrial and Engineering Chemistry*, Vol. 34, p. 163 (1942).

[9] "Determining the Brushability of Paints," Report of Sub-Committee No. 29, New York Paint and Varnish Production Club, *American Paint Journal*, Vol. 27, No. 4B, p. 20, I (1942).

[10] J. A. Geddes and D. H. Dawson, "Determination of Paint Consistency on the Modified Stormer Viscometer," presented before the Division of Paint, Varnish and Plastics Chemistry at the One Hundred and Third Meeting of the American Chemical Society at Memphis, Tenn.

[11] "General Specifications for Inspection of Material," Appendix VIII, Paint and Paint Ingredients, Methods of Sampling and Testing, U. S. Navy Department, Bureau of Ships, April 15, 1942, p. 17.

ber of springs for the range of consistencies covered.

When the data obtained with the recording viscometer is used to calculate yield value and mobility, less precision may be expected. The nonlinear curves obtained with the recording viscometer decrease the precision of this computation.

It has been pointed out that this instrument is not suitable for precision work, but can be used to determine consistencies bearing a definite relationship to A.S.T.M. Method D 562 consistencies as measured on the modified Stormer. At the same time it serves as a tool for the investigation of other rheological properties.

Mr. Bingham's final questions relate to temperature control, etc. In view of the limited precision of the instrument, it has been found satisfactory to use the same procedures as are usually recommended with the modified Stormer,[8] adjustment of the paint temperature to $\pm 0.25^\circ$C. before the determination.

Although the change of the surface level with increased rate of rotation might be of significance with a cylinder, or even with the fork paddle of the type frequently used with the modified Stormer, it has not been found of importance with the submerged paddle used in all of our investigations. Under these conditions the effect of the surface level at the center of the container is extremely small, at least within the limits of the rates of rotation and the practical paint consistencies studied.

The dimensions of the container are effectively limited by the construction of the instrument to within the permissible range. This may be more clear from an examination of Fig. 1. Careful centering on the table, within the range allowed by the set screws, is not important with the prescribed submerged paddle.

In the modified Stormer determinations, a pan for the weights was not used, due to the necessity, pointed out by Mr. Bingham, of correcting therefor.

Society for X-ray and Electron Diffraction

A NUMBER OF members of A.S.T.M. are active in the American Society for X-ray and Electron Diffraction (ASXRED) which was organized late in 1941. This organization is affiliated with the American Institute of Physics and on January 23 a meeting was held jointly with the American Physical Society at Columbia University at which Professor P. Debye presented a paper on "Recent Development in X-ray and Electron Diffraction." There are other papers dealing with crystal structure, age hardening, short and long range order in alloys, shape of powder lines, the electron microscope, etc.

This organization has at the present time a membership of about 200. Organized originally in connection with a Gibson Island Conference, it has for its object the promotion of progress in the use of X-ray diffraction and electron diffraction methods for the study of the structure and composition of matter. Annual dues for the organization are $1.50. There is no entrance fee. The President for the 1943 term is Prof. M. J. Buerger of the Massachusetts Institute of Technology; Dr. L. H. Germer of the Bell Telephone Laboratories is Vice-President; and the Secretary who has served since the organization of the Society is Dr. George Tunell, Geophysical Laboratory, Washington, D. C.

This organization and the A.S.T.M. are sponsors of a Joint Committee on Chemical Analysis by X-ray Diffraction Methods, headed by Prof. Wheeler P. Davey, The Pennsylvania State College. This group is responsible for the extensive file of over 4000 cards on X-ray Diffraction Data for Chemical Analysis which are available in published form from A.S.T.M. Headquarters at $50 a set.

Mass Purchasing of Supplies in New York

AN ANNOUNCEMENT from the American Municipal Association indicates that cities, counties, and school districts in New York are to be given the right to buy equipments and supplies through the state division of standards and purchase. In addition to the price advantage, the municipalities can purchase under scientific specifications, and the articles purchased will be subjected to tests in the state's testing laboratories. The plan is to be directed by the New York State Conference of Mayors. More than a dozen states, including Michigan, New Hampshire, Alabama, Wisconsin, and Pennsylvania, have cooperating purchasing systems.

1943 Victory Book Campaign

UNDER THE JOINT AUSPICES of the American Red Cross, the American Library Association, and the United Service Organizations, the 1943 Victory Book Campaign is under way from January 5 to March 5. Literature received from the sponsors stress the importance of this program to provide more and better books for our armed services. They will provide a source of morale and information, and they will be distributed directly to the soldiers, sailors, marines, coast guards, and merchant seamen. Books will be provided for the USO centers outside the camps, and for the American Merchant Marine Library Association; and finally, in the event of an over-supply, for the men, women, and children in defense areas where increased population has taxed the facilities of local libraries.

Material Desired:

Conferences held by the sponsors with the Army and Navy Special Services officers indicate preferences for the following kinds of books.

1. Current best sellers (Book of the Month, Literary Guild, and other book club selections) and the more recently published (1930 to date) popular fiction and non-fiction, in *good* physical condition.
2. Adventure and westerns, detective and mystery fiction in *good* physical condition. (These are described by camp librarians as the two types of books most sought after and most read by the men.)
3. Technical books published since 1935 in the fields of

Architecture	Meteorology
Aeronautics	Military science
Chemistry	Navigation
Drawing	Photography
Machine mechanics and design	Physics
Mathematics	Radio
Mechanical drawing	Shop mechanics, etc.

4. Humorous books—books of jokes, humorous stories, anecdotes, cartoons, and group games in *good* physical condition.
5. Pocket Books, and other small-sized editions of popular titles.

The slogan for the campaign is: "Any book you really want to keep is a good one to give."

Local libraries are cooperating and acting as collection centers.

Effect of Height of Test Specimens on Compressive Strength of Concrete*

By James W. Johnson[1]

SYNOPSIS

The A.S.T.M. Standard Method of Securing Specimens of Hardened Concrete from the Structure (C 42 – 39)[2] prescribes correction factors to be applied to the compressive strength values of specimens of various heights. This paper reports the results of a study to determine the reliability of some of these factors and to determine whether the loss of compressive strength with increase in height of cylindrical specimens cast with their long axes vertical may be due to water gain in the taller specimens.

The results reported indicate that the standard correction factors are reliable for all values of *h/d* except 1.00, and those in excess of 2.00. They also show some indication that loss of compressive strength of tall cast specimens made from concrete of wetter consistencies may be due to water gain.

It has been the practice of the Iowa State Highway Commission to correct the compressive strength of cores drilled from pavements by using the correction factors prescribed in A.S.T.M. Standard Method of Securing Specimens of Hardened Concrete from the Structure (C 42 – 39).[2]

A recent investigation involved compression tests of a large number of specimens made from plastic mortar. These included 2-in. cubes; 2 by 2 by 4-in. prisms, cast with their long axes horizontal; and 2 by 4-in. cylinders. The average strength of the 2-in. cubes was 1.06 times that of the 2 by 2 by 4-in. prisms. This would indicate a correction factor of 0.96 for the cubes, while A.S.T.M. Method C 42 prescribes a correction factor of 0.85 for cylindrical concrete specimens having the same *h/d* ratio. When the average strength of the 2 by 4-in. cylinders was compared with that of the 2-in. cubes, the strength ratio was found to be 1.22, which indicates a correction factor of 0.82. It was noted that most of the cylindrical specimens broke near the top. This phenomenon suggested that the relative difference in strength between the horizontally cast prisms and the vertically cast cylinders might be due to water gain in the cylinders.

In recent years Iowa has constructed, on its lighter traffic roads, a number of miles of concrete pavement which is only 6 in. thick in the center section. The core samples are taken from this center section, and when a core 6 in. long and $4^1/_2$ in. in diameter is prepared for capping by sawing one end, the *h/d* ratio often approaches 1.00. According to Method C 42, the strength correction factor when *h/d* equals 1.00 is 0.85, which corresponds to a ratio of about 1.18. Because of this rather large correction, and due to the fact that tests on mortar specimens indicated a lower correction factor, it was decided to make a short series of tests using the quality of concrete specified for the low traffic pavements to indicate the effect of height of test specimens over a limited range.

Outline of Tests

The series of tests called for making 6-in. diameter cylinders in five lengths, from 6 to 17 in., cast in both horizontal and vertical positions. The specimens were cast horizontally to eliminate the effect of water gain so far as possible. One proportion, 1:3.04:3.71 by weight, was used for all specimens. This proportion was chosen because it was one specified for the low traffic pavements. To accentuate the effect of water gain three consistencies of concrete were used. These corresponded to slumps of 1, 3, and 6 in., which would be the range used on pavement and reinforced concrete work.

Two gradings of coarse aggregate were used, one having a maximum size of $1^1/_2$ in., and the other having a maximum size of $^3/_4$ in. The coarse aggregate was separated into three sizes and recombined into the coarser and finer mixes in the following amounts:

	Coarse Grading	Fine Grading
$1^1/_2$ to $^3/_4$-in. material	40	..
$^3/_4$ to $^3/_8$-in. material	35	60
$^3/_8$ in. to No. 4 material	25	40

The concrete for the specimens cast in a horizontal position was introduced through a 2-in. slot in the side of the mold. It was anticipated that this would be somewhat difficult in the case of a mixture containing $1^1/_2$-in. aggregate and that this might influence the uniformity of results of strength tests. Therefore, the mixture containing the finer aggregate was included.

The concrete was hand mixed and placed by rodding. The consolidation of the concrete by placing the mold on a vibrating table was considered, but when a horizontally cast specimen, so consolidated, was split lengthwise it showed a massing of the coarse aggregate near its center. Possibly less amplitude of vibration, or greater frequency, would have overcome this difficulty. Machined base plates were used on both ends of the specimens cast horizontally, and on one end of the specimens cast vertically, thus limiting capping to a minimum. Two horizontal and two vertical molds for each height were available for the work, so twenty specimens could be made in one day. Not more than one specimen for each variable was made on the same day, thus three days were required to complete a series. The molds were made watertight by the use of paraffin.

Discussion of Results

The results of tests are summarized in Table I. It must be admitted that even though every precaution was taken to make uniform concrete, the test results showed a few specimens which varied greatly from the average and no explanation can be offered. All test results were included in the averages, however. It was hoped that the

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

* Presented at the Forty-fifth Annual Meeting, Am. Soc. Testing Mats., Atlantic City, N. J., June 22–26, 1942.

[1] Laboratory Chief, Iowa State Highway Commission, Ames, Iowa.

[2] 1939 Book of A.S.T.M. Standards, Part II, p. 320.

TABLE I.—AVERAGE COMPRESSIVE STRENGTH OF CYLINDERS 6 IN. IN DIAMETER.

Age at Test—28 days.

Ratio of Height to Diameter, h/d	Specimens Cast Horizontally						Specimens Cast Vertically						Average
	Coarse Aggregate						Coarse Aggregate						
	Fine Grading			Coarse Grading			Fine Grading			Coarse Grading			
Slump, in....	1	3	6	1	3	6	1	3	6	1	3	6	
	Average Compressive Strength, psi. (Each value is the average of six specimens)												
1.00......	2890	2838	2423	3572	3112	2828	3242	3082	2740	3950	3278	2867	...
1.33......	2978	2747	2388	3470	3132	2633	3067	2978	2548	3655	3115	2685	...
1.67......	2825	2812	2280	3237	2875	2500	3078	2912	2503	3283	2740	2437	...
2.00......	2758	2593	2253	3255	2845	2518	2868	2877	2410	3385	2997	2577	...
2.83......	2583	2507	2152	3220	2712	2365	2918	2702	2237	3318	2907	2320	...
	Above Values Expressed as Percentages of Strength when h/d Equals 2.00												
1.00......	104.8	109.4	107.5	109.3	109.4	112.3	113.0	107.1	113.7	116.7	109.4	111.3	110.4
1.33......	108.0	105.9	106.0	106.6	110.1	104.6	106.9	103.5	105.7	108.0	103.9	104.2	106.1
1.67......	102.4	108.4	101.2	99.5	101.1	99.3	107.3	101.2	103.9	97.0	91.4	94.6	100.6
2.00......	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2.83......	93.7	96.7	95.5	99.0	95.3	93.9	101.7	93.9	92.8	98.0	97.0	90.0	95.6
	Average Deviation from Average of Six Cylinders in Each Group												
1.00......	5.0	5.1	4.7	5.7	6.0	6.3	7.6	4.7	4.4	2.6	7.2	4.5	...
1.33......	2.3	4.7	2.3	8.0	4.3	5.1	5.0	1.5	4.6	1.1	4.5	2.3	...
1.67......	4.8	8.4	4.4	6.8	3.8	3.5	4.6	2.5	4.9	4.1	2.2	2.8	...
2.00......	3.5	5.6	2.4	5.4	2.6	3.5	4.0	3.4	4.3	4.4	2.1	1.5	...
2.83......	4.1	4.0	3.0	5.9	3.4	3.7	2.4	8.8	7.7	4.5	3.1	2.7	...

average deviation from the average for each group of specimens would not be more than 5 per cent, but because of the limited number of specimens in a group and the occasional erratic result, the maximum deviation from the average was 8.8 per cent for one group of specimens, and the standard deviation for this same group was 12.3 per cent.

The specimens cast vertically were about 5 per cent stronger than the specimens cast horizontally. Some investigators have found this to be the case, while others

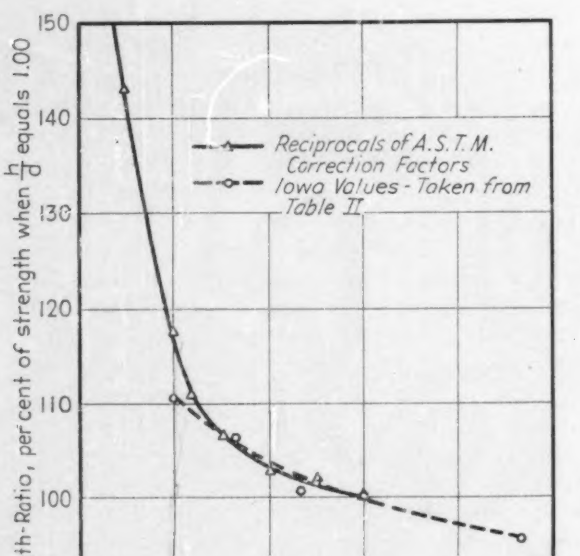


Fig. 1.—Relation of Height and Diameter of Test Specimen to Compressive Strength.

have not. The rodding of the concrete in the horizontally cast specimens was probably not so effective as it was in those cast vertically. This probable difference in consolidation may account for the difference in strength. The strength results when reduced to a percentage of the strength when h/d equals 2.00 indicate little difference between the two methods of casting the specimens.

A comparison between the two methods of casting is shown in the following tabulation:

Ratio of Height to Diameter, h/d	Percentage of Strength when h/d Equals 2.00	
	Horizontally Cast	Vertically Cast
1.00...........	108.8	111.9
1.33...........	106.9	105.4
1.67...........	102.0	99.2
2.00...........	100.0	100.0
2.83...........	95.7	95.6

The averages of all the strength ratios for specimens of equal height were plotted as shown in Fig. 1. Each point on this curve is the average of 72 specimens.

The ratios corresponding to the correction factors as specified in Method C 42 when plotted, in part, as a curve are also shown in Fig. 1. The two curves agree closely except at one point—where h/d equals 1.00. The present results indicate that for specimens having an h/d ratio equal to 1.00 the application of the A.S.T.M. standard correction factor will give results about 6.5 per cent too low. It will be noted that for no group of specimens in this series was the ratio of the strength when h/d equals 1.00 to the strength when the h/d equals 2.00 as high as that indicated in Method C 42. The results also indicate that if specimens higher than twice the diameter are tested, a small correction should in some cases be considered.

The strength ratio of vertically cast specimens 17 in. long was 99.9 per cent when the slump was 1 in., and 91.4 per cent when the slump was 6 in. Corresponding values for horizontally cast specimens were 96.4 and 94.7 per cent, indicating that there may be some loss of strength due to water gain on vertically cast specimens of considerable height.

A brief examination of some published reports, some dealing directly with the effect of height of test specimens and others written in connection with tests on cubes,

TABLE II.—EFFECT OF HEIGHT OF TEST SPECIMENS ON COMPRESSIVE STRENGTH AS REPORTED BY SOME INVESTIGATORS.

Ratio of Height to Diameter, h/d	Strength, expressed as a percentage of the strength when h/d equals 2.00						
	A.S.T.M. Method C 42 – 39[a]	Gonnerman[b]	Hutchinson[c]	A.C.I.[d]	Iowa Fig. 1	Koenitzer[e]	Gilkey and Murphy[f]
0.50	200	178	190	208	...	...	...
0.75	143	137	140	165	...	...	...
1.00	118	114	119	135	110	102	103 to 108
1.10	111	...	...	...	...	...	...
1.25	106	106	108	114	106	...	...
1.50	103	103	104	104	104	...	...
1.75	102	...	...	...	102	...	...
2.00	100	100	100	100	100	100	100
2.50	...	97	97	98	97	...	...
3.00	...	95	95	96	95	...	...

[a] These values are reciprocals of the values for "Strength Correction Factors" prescribed.
[b] H. F. Gonnerman, "Effect of Size and Shape of Test Specimen on Compressive Strength of Concrete," *Proceedings*, Am. Soc. Testing Mats., Vol. 25, Part II, p. 237 (1925).
[c] G. W. Hutchinson, "Correction Data for Comparative Test Results from Field Specimens," *Proceedings*, Am. Concrete Inst., Vol. XIX, p. 191 (1923).
[d] *Proceedings*, Am. Concrete Inst., Vol. X, p. 422 (1914).
[e] L. H. Koenitzer, "Modified Cube Compression Test," *Proceedings*, Am. Soc. Testing Mats., Vol. 34, Part II, p. 417 (1934).
[f] H. J. Gilkey and Glenn Murphy, "Discussion on Modified Cube Compression Test," *Proceedings*, Am. Soc. Testing Mats., Vol. 34, Part II, p. 414 (1934).

modified cubes and prisms, gives comparative strength results as shown in Table II. The table shows a very close strength relationship for all ratios of h/d of 1.50 or more. The strength ratios when h/d equals 1.00 vary from 1.02, as reported by Mr. Koenitzer in his discussion when comparing cubes and prisms from the same beam, to a maximum of about 1.35 as taken from a curve shown in the *Proceedings* of the American Concrete Institute,[3] with the value of 1.18 from Method C 42 midway between these two extremes.

Conclusions

The limited scope of this investigation prevents the formation of definite conclusions. The results of tests indicate, however, that for some combinations of materials and proportions, a smaller correction factor should be applied than that prescribed in Method C 42 when h/d equals 1.00. The tests further indicate that in some cases a correction factor should be applied if specimens are broken when the length of such specimens is greater than twice the diameter. It appears that when the height approaches the diameter the correction factor becomes more critical, depending upon the type of specimen and the method of molding, and should it be desired to correct the strength of any number of important specimens to compare with the strength of specimens of other sizes and shapes, it would be well for the testing agency to investigate the strength of the different types of specimens and possibly develop special correction factors.

[3] Report of Committee on Concrete Materials, *Proceedings*, Am. Concrete Inst., Vol. X, p. 424 (1914).

DISCUSSION

MR. H. F. GONNERMAN.[1]—Mr. Johnson has reported a considerable number of tests, the results of which agree in the main with those published previously. In some of the earlier tests reported, a considerable variation in results was observed in the range of $h/d = 1.0$ and less. Therefore it would have been of considerable interest had Mr. Johnson extended his tests beyond the point where the solid curve (Fig. 1) changes direction rapidly. In tests of 6-in. diameter cylinders of various lengths reported by the writer[2] a strength ratio of 112 per cent at 28 days was obtained for 6 by 6-in. cylinders ($h/d = 1.0$) which does not differ greatly from the value of 110 per cent which Mr. Johnson obtained in his tests for this length of cylinder.

MR. J. C. PEARSON.[3]—I should like to ask Mr. Johnson whether his data indicate that the ratio varies with the absolute strength.

MR. JAMES W. JOHNSON.[4]—There again our project was limited. We used three water contents and the strength range varied considerably for this range of consistencies. The data did not indicate that the ratio varied consistently with the strength.

[1] Manager, Research Laboratory, Portland Cement Assn., Chicago, Ill.

[2] H. F. Gonnerman, "Effect of Size and Shape of Test Specimen on Compressive Strength of Concrete," *Proceedings*, Am. Soc. Testing Mats., Vol. 25, Part II, p. 237 (1925).

[3] Director of Research, Lehigh Portland Cement Co., Allentown, Pa.

[4] Laboratory Chief, Iowa State Highway Commission, Ames, Iowa.

MR. PEARSON.—The reason for the question was that I recall in an investigation of the relation between compressive strength of concrete and 2-in. plastic mortar cubes some years ago—an investigation sponsored by Committee C-1 on Cement—that the early strength of the cubes was relatively nearer to the concrete strength than it was at later ages. Also, in testing some vermiculite concrete mixtures, which are very weak in comparison with normal concrete, we obtained about the same compressive strength with 2-in. cubes and with 3 by 6-in. cylinders. In both of these cases there is an indication that the ratio of height to diameter of specimen does not have so much effect on low-strength mixtures as upon high-strength mixtures.

MR. ROY W. CRUM.[5]—Mr. Johnson did not elaborate on what custom has decreed should be the final section of a research paper, that is, the additional needed research. This gives me an excuse to introduce into the record brief mention of two phases of this general problem that I think need study. One is the possible effect of horizontal restraint at the ends of compression specimens as they are now tested. It is thought by some that if the specimens could be tested without this restraint it might make some difference in the results, particularly in comparing specimens of different heights.

The other need for investigation is that of the relative

[5] Director, Highway Research Board, National Research Council, Washington, D. C.

sizes of compression test specimens. Do we get the same indication from a specimen 4 in. in diameter as from one 12 in. in diameter? It does not appear that conclusive tests along these lines have yet been made.

Neither one of these thoughts is original. I have picked them up recently from conversation with various people.

Another thought I have is to put up a plea for enough specimens in future investigations to make them properly subject to statistical methods of analysis, such as was used so advantageously in preparing the proposed method[6] for determining the lengths of core specimens which was presented by Committee C-9 on Concrete and Concrete Aggregates.

[6] Tentative Method of Measuring Length of Drilled Concrete Cores (C 174 – 42 T), 1942 Book of A.S.T.M. Standards, Part II, p. 1207.

MR. JOHNSON (*author's closure, by letter*).—Mr. Crum has pointed out the need for additional research for comparing the strengths of specimens of different heights and sizes. A research project is now being outlined which will involve the fabrication of concrete slabs of various sizes and thicknesses, to be cast horizontally and vertically. Specimens will be cut from these slabs with a silicon-carbide saw, and it is believed that information will be obtained regarding the effect of size and shape of test specimens, and the effect of the location of the specimen in a vertically cast slab, upon the compressive strength of concrete. This project will involve considerable sawing and it is therefore possible that the casting of the slabs for long-time tests will be all that can be accomplished until the war ends.

New Zealand Standards and A.S.T.M.

THE FOLLOWING New Zealand Emergency Standard Specifications, recently received, as issued by the New Zealand Standards Institute under the authority of the Minister of Supply contain references to A.S.T.M. specifications as listed. In general the references to A.S.T.M. specifications are such that the material covered by the New Zealand requirements must comply with the respective A.S.T.M. requirements.

New Zealand Emergency Standard Specifications for	A.S.T.M. Specifications for
Cold Rolled Mild Steel Strip (N.Z.S.S. E. 22)	Cold Rolled Strip Steel (A 109)
Structural Steel for Bridges and General Building (N.Z.S.S. E. 21)	Steel for Bridges and Buildings (A 7)
Structural Steel for Shipbuilding (N.Z.S.S. E. 20)	Structural Steel for Ships (A 131)
Cold-Drawn Steel Wire for Concrete Reinforcement (N.Z.S.S. E. 19)	Cold-Drawn Steel Wire for Concrete Reinforcement (A 82)
Rolled Steel Bars for Concrete Reinforcement (N.Z.S.S. E. 18)	Billet-Steel Bars for Concrete Reinforcement (A 15)
Tempered Steel Spring Wire (N.Z.S.S. E. 16)	Oil-Tempered Steel Spring Wire (A 229)
Lap-Welded and Seamless Steel and Lap-Welded Iron Boiler Tubes (N.Z.S.S. E. 10)	Lap-Welded and Seamless Steel and Lap-Welded Iron Boiler Tubes (A 83)
Seamless Steel Boiler Tubes for Hot-Pressure Service (N.Z.S.S. E. 9)	Seamless Steel Boiler Tubes for High-Pressure Service (A 192)
Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses (N.Z.S.S. E. 8)	Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses (A 120)

New Zealand Standard War Emergency Purchasing Direction for	A.S.T.M. Specifications for
Bright Steel Shafting (N.Z.S.S. P.D. 20)	Commercial Cold-Finished Bar Steels and Cold-Finished Shafting (A 108)
Black Steel Bars (N.Z.S.S. P.D. 19)	Commercial Quality Hot-Rolled Bar Steels (A 107)
Enamelling Quality Steel Sheets (N.Z.S.S. P.D. 16)	Cold-Rolled Strip Steel (A 109)
Steel Bars for the Manufacture of Collars for Shafting (N.Z.S.S. P.D. 7)	Commercial Cold-Finished Bar Steels and Cold-Finished Shafting (A 108)

These New Zealand Standards can be purchased for about twelve cents each from the Secretary, New Zealand Standards Institute, Wellington, C. 1.

New Conservation—Salvage Set-Up in WPB

A NUMBER OF RECENT changes have been announced involving personnel in the War Production Board, and the re-arrangement of various activities of the Board. Some of these changes are of considerable importance to members of the Society because of contacts many of the members have had with the work of these branches. There has been formation of a new Salvage Division, consisting essentially of the former Salvage Branch of the Conservation Division, the new division being headed by Paul C. Cabot. Concurrent with this change was the continuance of the technical branches of the Conservation Division under the present set-up. These three branches are as follows:

Specifications Branch, C. L. Warwick, Chief
Simplification Branch, Robert B. Shephard, Chief
Conservation and Substitutions Branch, Harvey A. Anderson, Chief.

With the resignation, announced in the press, of Lessing J. Rosenwald as Chief of the former Conservation Division, Howard Coonley has assumed the head of this newly constituted division. During Mr. Rosenwald's tenure of office the conservation activities were greatly expanded, and many valuable results were achieved, both in the technical and in the salvage division's work.

Publication on Aluminum Alloy Casting Grades

A RECENT PUBLICATION prepared by the Federated Metals Division of the American Smelting and Refining Co. may be of considerable interest to those members of the Society, both producers and consumers, who are concerned with various grades of aluminum alloys—casting grades. This lists various specification symbols, Federal, Army, Navy, A.S.T.M., etc., with the complete chemical composition, the minimum tensile strength, and the minimum elongation. The data are grouped according to the types of alloys with supplementary information on general physical characteristics on each sheet. An index is helpful in locating quickly the sheets where data are given on permanent mold castings, die castings, etc. The company has offered to send a copy without charge to those whose activities concern this field. The Federated Metals Division is located at Russell and Woodland Aves., Detroit, Mich.

A Direct Determination of Rubber Hydrocarbon Chromic Acid Oxidation Method*

By V. L. Burger,[1] W. E. Donaldson,[a] and J. A. Baty,[1]

EDITOR'S NOTE.—The members of Subcommittee XI on Chemical Analysis of Rubber Products of Committee D-11 on Rubber Products were so impressed by the timeliness and inherent value of this method for direct determination of rubber hydrocarbons that Doctor Baty was asked to present it at the main meeting of Committee D-11 held in June, 1942. There is great need for a standard method and Committee D-11 has a section studying the proposals outlined below with the possibility of recommending them as proposed tentative methods.

LACK OF A PRACTICAL method for the direct determination of rubber has made it customary to estimate rubber in rubber products by difference,[2] a procedure obviously open to large errors of summation and interpretation.

The procedure of Kuhn and L'Orsa[3] for the analytical oxidation of organic compounds using chromic acid was applied by them to numerous compounds, including some containing the structure

$$\begin{array}{c} \quad CH_3 \\ \quad | \\ -CH_2-C=CH- \end{array}$$

They found that most of the molecule was oxidized to carbon dioxide and water, but that the portion containing a side-chain methyl group formed a molecule of acetic acid which they separated and estimated. The yields of acetic acid apparently depended on the molecular structures involved.

A modification of this method was applied to rubber by Kheraskova and Korsunskaya.[4] In a preliminary note they reported obtaining acetic acid from smoked sheet using steam distillation during the chromic acid oxidation. No details were given. The reported results were 95.3 to 96.5 per cent rubber hydrocarbon content for smoked sheet. These values appear to be based on the generally accepted theory of a polyisoprene structure for rubber hydrocarbon, each isoprene unit having one side-chain methyl group, and the assumption of the production of one molecule of acetic acid by the oxidation of each isoprene unit.

Of the possible methods for the direct determination of rubber, this was deemed most worthy of further investigation. In this work, the authors have obtained values which indicate a 75 per cent yield in the reaction producing one molecule of acetic acid from each isoprene unit in rubber hydrocarbon. Because this value was found to be quite duplicable, it was feasible to use the reaction as the basis of an empirical method for the estimation of rubber in rubber stocks.

From the theoretical point of view, this method presents some interesting aspects. The 75 per cent yield of acetic acid was obtained in spite of great variation in the oxidizing conditions, leading to the tentative conclusion that this figure is characteristic for rubber—in other words, that either rubber hydrocarbon is not pure polymerized isoprene or that some of the isoprene units are in a form which does not allow their oxidation to acetic acid.

In spite of the unsatisfactory theoretical basis for the method, it is presented in its present state in the hope that it may be of some value in connection with the present war effort.

The development of chromic acid oxidation as an analytical method for rubber was accomplished in two stages. Investigation was first made to ascertain that the oxidation was quantitative, to establish the type of procedure necessary, and to determine the applicability of the method. When this fundamental work had been done, further investigation was made to simplify the procedure and apparatus.

The determination of rubber by chromic acid oxidation involves four steps: digestion of the sample in the oxidizing mixture, distillation to separate the acetic acid which is formed, aeration of the distillate to remove carbon dioxide, and titration of the acetic acid. The investigation of various phases of the analytical procedure is summarized below.

DIGESTION MIXTURE

The digestion of the sample requires an elevated temperature. Preliminary runs using a chromic acid - phosphoric acid digestion mixture indicated that a temperature of approximately 130 to 135 C. was necessary for complete digestion of some rubber samples. The volatility of chromic acid under these conditions was sufficient to produce a distillate containing significant amounts of this substance, a situation already encountered by Kuhn and L'Orsa.[3]

For convenience in operation it was desirable to digest at the boiling point of water. To meet this requirement other mixtures were tried and it was found that a range of chromic acid - sulfuric acid mixtures was satisfactory. A mixture containing 25 per cent sulfuric acid and 18 per

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[2] R. P. Dinsmore, R. H. Seeds, and H. E. Rutledge, "The Chemistry and Technology of Rubber," p. 872, Davis and Blake, Editors, Reinhold Publishing Corp., New York, N. Y. (1937).

[3] R. Kuhn and F. L'Orsa, "Analysis of Organic Compounds by Chromic Acid," *Zeitschrift für angewandte Chemie*, Vol. 44, pp. 847–853 (1931).

[4] E. Kheraskova and E. Korsunskaya, "A New Method for the Direct Determination of Rubber," *Caoutchouc and Rubber* (U.S.S.R.), No. 7–8, July–August, 1937, p. 39, as translated by Charles Blanc, *Rubber Chemistry and Technology*, Vol. 11, p. 438 (1938).

TABLE I.—OXIDATION OF ACETIC ACID IN 2 HR. DIGESTION AT 100 C.

Composition of Digestion Mixture, per cent		Milliequivalents Acetic Acid Taken	Milliequivalents Acetic Acid Recovered	Acetic Acid Recovered, per cent
H_2SO_4	CrO_3			
33	24	3.255	3.167	97.3
33	24	3.483	3.302	94.8
31.5	23	3.483	3.455	99.2
30	21.5	3.483	3.476	99.8

cent chromic acid by weight was found to dissolve crude rubber completely at 100 C. within 1 hr. Mixtures containing more than 30 per cent sulfuric acid and 22 per cent chromic acid were found to attack acetic acid in a 2-hr. digestion period, as shown in Table I.

The digestion mixture chosen for routine use contains 28 per cent sulfuric acid and 20.5 per cent chromic acid, a more dilute mixture than those which oxidized any appreciable part of the acetic acid. It was found that in using this digestion mixture under the conditions of the procedure, a distillate containing negligibly small amounts of chromic acid was obtained.

Time of Digestion:

The data on the attack of acetic acid by the digestion mixture (Table I) indicate that a digestion period as long as 2 hr. does no harm. Qualitative tests demonstrated that 15 to 30 min. normally are adequate for digestion, and numerous quantitative tests indicated that the reaction is complete if the sample has gone completely into solution. One-hour digestion time was selected for use in the routine analysis.

Rate of Distillation

A number of tests were run in order to find whether it is necessary to control the rate of distillation in order to get satisfactorily reproducible low blank analyses. In all cases, using apparatus as described herewith, and varying the time of distillation from 20 to 90 min., the blanks amounted to approximately 0.25 to 0.35 ml. of 0.1*N* acid per 500 ml. of solution distilled. In like manner it was demonstrated that acetic acid added to the distillation flask was approximately quantitatively contained in the first 300 ml. of distillate, whether the time of distillation was 20 min. or 90 min. Any intermediate rate of distillation is considered satisfactory.

Removal of Carbon Dioxide

It was demonstrated in early experiments that the portion of the rubber hydrocarbon molecule which in the course of the analysis does not form acetic acid, is oxidized to carbon dioxide and water. It is necessary to remove any carbon dioxide from the receiving flask before titration of the acetic acid. In testing the present method of removal of carbon dioxide, the authors added carbon dioxide to an aqueous solution containing a known quantity of acetic acid and passed air through the solution as directed by the procedure. The results indicated that under these conditions an aeration period of at least 10 min. is necessary, but that if the aeration is made at room temperature a sweeping time as long as 30 min. does no harm (Table II). An aeration period of 30 min. was selected for general use in the method.

TABLE II.—REMOVAL OF CARBON DIOXIDE FROM DILUTE ACETIC ACID SOLUTION BY AERATION.
(Rate of aeration was approximately 2 liters per minute.)

Time of Aeration, min.	Volume of Solution, ml.	Milliequivalents Acetic Acid Taken	Milliequivalents Acetic Acid Found	Apparent Recovery of Acetic Acid, per cent
0	400	3.560	4.730	133
5	400	3.560	3.675	103
10	400	3.560	3.560	100
15	400	3.560	3.554	99.8
20	400	3.560	3.554	99.8
30	400	3.560	3.557	99.9

Titration

In following the procedure given in this paper, 30 to 35 ml. of 0.1*N* sodium hydroxide will normally be required. No special technique is involved since phenolphthalein was selected as the indicator for routine use. The authors consider that in this analysis there may be some advantage in the use of a phenolphthalein-thymol blue mixture consisting of 0.045 g. of phenolphthalein and 0.015 g. thymol blue dissolved in 30 ml. of 95 per cent alcohol and diluted with 30 ml. of water.

Apparatus and Reagent

Figure 1 gives a diagram of the apparatus. The digestion and distillation apparatus can be conveniently assembled on a ringstand with a tripod foot. The use of rubber connections must be avoided where they might come into contact with the digestion mixture.

The aeration assembly contains a capillary tube which, when connected to the vacuum line, will maintain through the receiving flask an air flow of approximately 2 liters per minute. If the pressure in the vacuum line is less than 30 mm. of mercury, an approximately 10 cm. length of capillary tube of 0.75 mm. bore will maintain the required air flow.

Since it is essential that the aeration be maintained at a rate within 10 to 20 per cent of that specified above, each capillary tube should be tested before use. The following method of test is suggested: Invert a graduate over a beaker filled with water and evacuate the air through the capillary by means of a tube extending up into the graduate. The rate of air flow, of course, is the same as the rate at which water fills the graduate.

The chromic acid digestion mixture used may be pre-

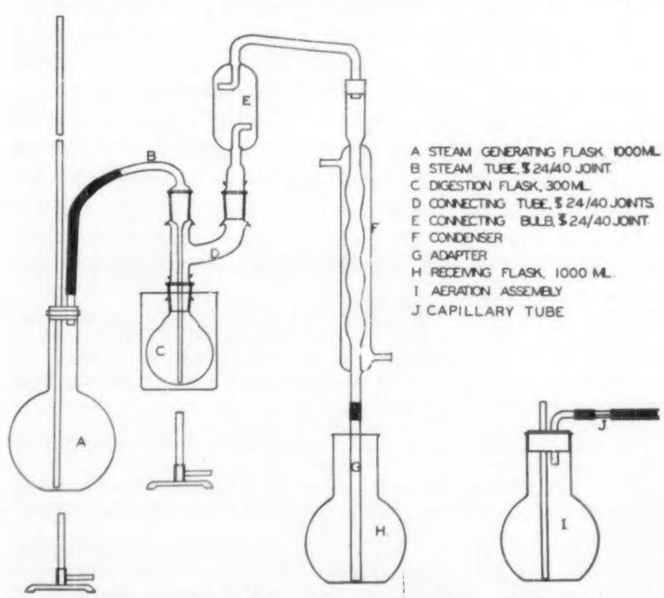

Fig. 1.—Apparatus for Direct Determination of Rubber Hydrocarbon.

pared as follows: Dissolve 200 g. of reagent grade chromic oxide (CrO_3) in 500 ml. of distilled water and add 150 ml. of reagent grade 96 per cent sulfuric acid. Mix well.

Procedure

The procedure consists of the following:

1. Weigh a sheeted sample (0.5 mm. or thinner) of a size sufficient to contain approximately 0.3 g. of rubber hydrocarbon.

Note.—Samples thicker than 0.5 mm. will sometimes behave satisfactorily in the analysis. However, thicker sheets of some materials (for example, crude rubber) may not be completely attacked by the oxidation mixture in the time specified for the digestion of the sample.

2. Wrap the sample loosely in filter paper and extract it with acetone for at least 8 hr.

3. In the analysis of vulcanized rubber products, extract with chloroform for 4 hr. In the analysis of crude rubber or poorly vulcanized stocks, omit this step. (Although it is necessary to omit this step when chloroform extraction would remove an appreciable portion of the rubber hydrocarbon, the omission, itself, may introduce an error due to the failure to remove certain interferences, if present.)

4. Dry the sample in an oven at approximately 100 C. for 1 hr.

5. Set up the apparatus as shown in Fig. 1.

6. Place 700 to 900 ml. of distilled water in the steam-generating flask *A*.

7. Place a few milliliters of water in the receiving flask *H* (sufficient to cover the end of the adapter).

8. Place 50 ± 1 ml. of digestion mixture in the digestion flask *C*.

Note.—The digestion flask should be marked on the side at a point indicating the liquid level when the flask contains 75 ml.

9. Lift the steam tube *B* and insert the sample into the digestion flask *C*. (It is not necessary to quantitatively remove the filter paper from the sample before transferring it to the digestion flask as the interference of small amounts of cellulose is negligible.) Replace the steam tube and tighten the connection.

10. Heat the beaker of water surrounding the digestion flask *C* to boiling. Continue boiling for 1 hr.

11. At the end of this time remove the beaker of hot water from around the digestion flask *C* and remove the burner from beneath it.

12. During the digestion period heat the steam-generating flask *A*, with the stopper removed, until the contents are boiling.

13. Replace the stopper and outlet tube in the mouth of the steam-generating flask and adjust the burner to maximum heat, passing steam through the digestion flask.

14. When the volume of liquid in the digestion flask *C* is increased to approximately 75 ml., place the burner (with a small flame) under it, and keep the flame at a point where it will maintain the liquid at approximately this volume.

15. Continue the distillation until 500 ml. are collected in the receiving flask *H*.

16. Remove the burners and immediately remove the receiving flask *H* and the adapter *G*.

17. With a wash bottle rinse the adapter *G*, catching the rinsings in the receiving flask *H*.

18. Adjust the temperature of the liquid in the receiving flask to 25 ± 5 C., insert the aeration assembly into the receiving flask and attach to a vacuum line. Draw a stream of air through the liquid for 30 min. at approximately 2 liters per minute. (The rates of loss of carbon dioxide and of acetic acid during aeration have been investigated for the temperature range, type of apparatus and rate of air flow recommended in the procedure. Variation of any of these factors may lead to erroneous analytical results.)

19. Remove the rubber tubing and loosen the two-hole stopper. With a wash bottle rinse the two-hole stopper and the glass tubing, catching the rinsings in the flask.

20. Add phenolphthalein indicator and titrate with 0.1000*N* NaOH (volume X).

21. Repeat steps 5 to 8 and 10 to 20 to obtain a blank value for the apparatus (volume *Y*). This should be approximately 0.2 to 0.3 ml.

22. Calculate the results:

Percentage of rubber hydrocarbon =

$$\frac{0.908\,(\text{volume } X - \text{volume } Y)}{\text{weight of sheeted sample}}$$

This calculation is based on the observation that 75 per cent yield results in the reaction

$$(C_5H_8)_n \xrightarrow{O} nCH_3COOH$$

using purified rubber. To consider the determination on the basis of crude rubber a suitable correction for nonrubber constituents is necessary.

Applicability

The behavior of various rubber compounding materials in the chromic acid oxidation procedure has been investigated and the findings are summarized in Table III. Though this method of analysis is obviously not specific for natural rubber, none of the common rubber compounding ingredients interferes markedly. No prediction is

TABLE III.—DEGREE OF INTERFERENCE OF RUBBER COMPOUNDING INGREDIENTS IN ANALYSIS BY CHROMIC ACID OXIDATION.

Material	Interference
Combined sulfur	None in normal soft cures
Carbon black	None as tested in tread stocks
Cellulose	Negligible, equivalent to 2 per cent or less rubber hydrocarbon
Asphaltic hydrocarbon (mineral rubber)	Removed by extraction. If not extracted, equivalent to approximately 45 per cent rubber hydrocarbon
Factice, brown	Negligible after extraction (in case of samples tested)

TABLE IV.—BEHAVIOR OF RUBBER-LIKE MATERIALS IN CHROMIC ACID OXIDATION.

Material	Value
Hard Rubber	Low—approximately 50 per cent of expected value
Balata	Approximately equivalent to rubber
Thiokol RD	Equivalent to approximately 18 per cent rubber hydrocarbon
Perbunan	Negligibly low—equivalent to 1.5 to 2 per cent rubber hydrocarbon
Buna S	Very low—equivalent to approximately 3 per cent rubber hydrocarbon
Vistanex	Very low—sample virtually unattacked
Neoprene GN	Very low—equivalent to approximately 3 per cent rubber hydrocarbon. A modification of the procedure to avoid the interference of chlorine must be used[a]

[a] This modification of the procedure consists of adding neutral potassium iodide to the distillate after aeration (step 19 of the procedure) and titrating any iodine which may be liberated with neutral sodium thiosulfate before proceeding with step 20.

TABLE V.—REPRESENTATIVE ANALYSES.

Sample	Sample Weight, g.	Titration, ml. (corrected)	Rubber Hydrocarbon Found, per cent	Assumed or Calculated Rubber Hydrocarbon Content, per cent
Purified Rubber	0.312	34.49	100.4	100
Purified Rubber	0.270	30.12	101.0	100
Pale Crepe	0.319	33.47	95.3	94 to 95
	0.301	31.15	94.0	
	0.302	31.25	94.0	
	0.312	32.50	94.6	
	0.303	31.68	95.0	
	0.316	32.79	94.2	
	0.303	31.59	94.7	
	0.309	32.26	94.8	
	0.309	32.00	94.0	
	0.3085	32.15	94.6	
	0.320	33.20	94.2	
	0.320	33.22	94.3	
Vulcanizate No. 1	0.438	12.91	26.7	28.2 to 28.4
	0.404	12.35	27.7	
	0.4715	14.95	28.8	
Vulcanizate No. 2	0.3775	22.25	55.1	56.5 to 57.0
	0.367	21.95	55.3	
	0.3605	22.01	55.3	
Vulcanizate No. 3	0.4335	42.15	88.4	89.3 to 90.0
	0.3675	35.93	88.8	
Reclaim I	0.5060	29.20	52.4	56
	0.5130	29.31	51.9	
	0.5000	27.95	50.8	
Reclaim Vulcanizate I	0.5005	26.15	47.4	53
	0.5005	26.65	48.3	
	0.5000	26.05	47.3	
Reclaim II	0.5145	33.43	59.0	61
	0.5100	33.79	60.2	
	0.5135	33.40	59.1	
Reclaim Vulcanizate II	0.5005	30.55	55.4	58
	0.5005	30.75	55.8	
	0.5000	30.55	55.5	
Reclaim III	0.4995	29.20	53.1	60
	0.5010	28.95	52.4	
	0.5015	28.65	51.9	
Reclaim Vulcanizate III	0.5005	26.65	48.3	57
	0.5005	27.05	49.1	
	0.5000	26.65	48.4	
Reclaim IV	0.4990	42.02	76.4	84
	0.4995	42.61	77.6	
	0.5000	42.77	77.6	
Reclaim V	0.5010	30.65	55.6	59
	0.4990	30.59	55.6	
	0.5005	31.03	56.3	

made regarding possible interference by other compounding ingredients, many of which may come into general use in the near future.

In Table IV are listed the results obtained in applying the procedure to some rubber-like materials. The behavior of synthetic rubbers in the analysis still is being studied. Often data obtained by this method of analysis will be distinctly useful in the qualitative analysis of "elastomers" of unknown composition.

It was found that the method was also applicable to reclaim rubber, the results being comparable to those obtained with new rubber stocks. Results so far obtained are consistently lower than previously accepted estimates of the rubber hydrocarbon content.

The application of the method to reclaim is being studied further by the Technical Committee of the Executive Committee of the Rubber Reclaimers' Association. The method is now being studied by the Society's Subcommittee XI on Chemical Analysis of Rubber Products, of Committee D-11 on Rubber Products. Some of the details of the present paper are inserted at the suggestion of members of these committees.

Accuracy

Results may be expected to be accurate within 2 per cent based on the weight of the sample. Depending on the particular type of rubber, results are usually consistent to 0.5 per cent or less.

In evaluating the accuracy of the method, it should be noted that only in exceptional cases can the true rubber content of a sample be known more accurately than ±1 per cent.

Analytical Results

In Table V are listed the results obtained in a number of determinations using the above procedure. These data demonstrate the precision of the method.

Summary

A method for the direct determination of rubber is reported. This method utilizes the property of rubber hydrocarbon when oxidized by chromic acid to form definite and reproducible amounts of acetic acid.

This determination has been reduced to a comparatively simple laboratory procedure, whose accuracy (in the absence of interferences) is 1 to 2 per cent.

Plastics for Industrial Use

This new book by John Sasso, Associate Editor, *Product Engineering*, is intended as an engineering handbook of materials and methods and finishing with data on properties and methods of fabrication. Extensive data in the form of tables have been obtained from manufacturers' research and literature files, some of the information has been published in leading journals. The opening chapters cover comparative properties, molding methods, and discussion on engineering and finishing followed by chapters devoted to specific materials. This section of the publication comprises the major part of the volume of 236 pages. An Appendix gives a directory of trade names, suppliers, and molders and a detailed Index enables a quick reference to important topics.

The author has been in touch with leading authorities in the field and with many of the important companies concerned, and the compilation should be of help particularly to those engineers who are considering the use of plastics as engineering materials both as alternate materials and as replacements.

Copies of the volume can be obtained from the McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y., at $2.50 each.

Concrete Manual

The Bureau of Reclamation, U. S. Department of the Interior, has issued the Fourth Edition of its Manual for the Control of Concrete Construction. This edition differs from previous ones primarily in improvements in typography and quality of illustrations although there are some changes in text. The book covers concrete and concrete materials, the investigation and selection of aggregates, mixes, inspection, field laboratory supplies, manufacturing, etc. In the 80-page appendix are given the methods for sampling and testing which include numerous references to A.S.T.M. standards, many of the methods being based on Society standards. Copies of the 484-page book can be obtained from the Bureau of Reclamation in Denver, or in Washington, D. C., at $1.00 each.

Determination of the Particle Size Distribution of Portland Cement with a Specially Calibrated Pipette

By G. E. Monfore[1]

SYNOPSIS

Because of its simplicity and directness, the pipette method recommends itself for use in determining the particle size distribution of portland cement. In order that the calculations of results may be as simple as possible a pipette was directly calibrated for the determination of weight percentages finer than certain particle diameters: namely, 50, 20, 10, 5, and 2 μ, a range which covers well the normal distribution of portland cement. Pipette samples are taken from successively lesser depths, thereby reducing to 6 hr. the time required for an analysis. The procedure used in making determinations with the special pipette is outlined, and the results of tests which were made to determine the following are given: (1) variation due to changes of deflocculating agent and suspending medium, (2) reproducibility of the method, (3) particle size distributions of 21 cements from various parts of the United States and values of specific surface of these cements as determined from pipette analyses, air permeability measurements, and Wagner turbidimeter analyses, (4) effective aperture of the No. 325 sieve, and (5) values of specific surface from pipette analyses and turbidimeter analyses when calculations are made on the same basis.

The methods that have been used for the fineness analysis of granular materials, such as portland cement, are many and varied and even the briefest description of them would be too lengthy to be included here. The Symposium on New Methods for Particle Size Determination in the Subsieve Range (*1*),[2] however, contains descriptions of several of the methods and lists some two hundred references on the subject. Of the several sedimentation methods of analysis the pipette method is one of the simplest and most direct. It is the purpose of this paper to describe a pipette which was calibrated especially for the particle size analysis of portland cement and to give results of some of the analyses.

The pipette method of subsieve size analysis was developed independently in 1922 and 1923 in the United States, in England, and in Germany, and it has been used extensively in the study of various materials. For instance, Andreasen employing a specially designed apparatus studied pigments, while Hogentogler and Willis (*2*) used the pipette method for the analysis of soils. Loomis using the Andreasen pipette studied clays, and Jackson and Saeger (*3*) proposed a pipette method for determining the fineness of molding sand. The Andreasen pipette was employed by Lea and Nurse (*4*) in a study of portland cements.

One of the chief advantages of the pipette method is that it is a direct method: the weights of the various fractions are obtained from actual weighings on an analytical balance. This is not true of many other methods which must depend upon the measurement of some other property that is related to the particle weights. The theory of the pipette method is not at all complicated, and the calculations of the results using the pipette described here are very simple. The equipment required, other than an analytical balance, is also simple and inexpensive. The method does, however, possess the disadvantage common to all sedimentation methods; that is, considerable time is required when the analysis is carried down to particle diameters of 1 or 2 μ.

The pipette described in this paper was calibrated for use in the determination of the particle size distribution of portland cement using isopropyl alcohol as the suspending medium. By taking the pipette samples from depths which are less as the particle sizes being measured become smaller, the analysis from particles of 50 μ in diameter to particles of 2 μ in diameter is completed during a working day. With the commonly used Wagner turbidimeter (*5*) analysis down to particles of 7.5 μ in diameter is accomplished in a matter of minutes, but the calculations of the particle size-weight distribution are long and tedious. Moreover, as portland cements ordinarily contain about 25 per cent by weight of particles less than the smallest size measured (7.5 μ), the data obtained on the distribution are not very complete. Since the behavior of portland cement in concrete is probably greatly influenced by the smaller particles, a knowledge of the distribution of these particles may prove to be important. Another method of fineness analysis which is based on air permeability measurements is rapid and promises to be very valuable in obtaining surface area of cements. It does not, however, give data as to the particle size distribution.

Theory

The pipette method is based on Stokes' law for spherical particles falling in a viscous medium. The equation may be written

$$d^2 = \frac{1{,}837{,}000\,U}{P_1 - P_2}\,\frac{H}{t}$$

where

d = diameter of particles in microns,
U = viscosity of suspending medium in poises,
H = depth of settling in centimeters,
P_1 = density of particles in grams per cubic centimeter,
P_2 = density of suspending medium in grams per cubic centimeter, and
t = time of settling in seconds.

The application of the pipette method is limited by certain assumptions, including, of course, those involved in the derivation of Stokes' law. For instance, the particles are assumed to be spherical. This is not true of

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[2] The italic numbers in parentheses refer to the reports and papers appearing in the list of references appended to this paper.

portland cement; accordingly, values of diameters obtained by sedimentation methods are in terms of effective diameters rather than actual dimensions. Also, the particles are assumed to be completely dispersed and uniformly distributed throughout the medium at the beginning of the sedimentation. This problem of obtaining complete dispersion of the sample is one of the most difficult problems involved in the procedure of any sedimentation method of analysis. Hinkley (*6*) mentions a few substances which have been used as deflocculating agents; Bauer (*7, 8*) discusses the dispersion of soils. The general subject of dispersion is a topic to be found in various books on colloid chemistry. Stokes' law holds only over a limited range of particle diameters. Bauer (*8*), in discussing soils, indicates that the applicable range of Stokes' law is from particle diameters of 0.2 μ to 200 μ. Martin (*9*) states that "0.5 to 1 μ may be taken as the lower limit for many materials," and gives a formula for computing the upper limit, according to which the maximum diameter for portland cement particles suspended in isopropyl alcohol at 72 F. is calculated to be 180 μ. Thus particle diameters from 2 μ to 50 μ are well within the range of validity of Stokes' law.

If a suspension prepared in accordance with the necessary conditions is allowed to settle for a time t, then in accordance with Stokes' law, all particles larger than diameter d will have fallen below a depth H measured from the upper surface. A sample taken with a pipette whose tip is at depth H will contain only particles of diameter less than d, and the weight of these particles divided by the weight of all particles in the same-size sample of the original suspension will be the fractional part of the sample which is finer than diameter d. Hence by taking several samples at various depths and time intervals, the particle size distribution may be obtained.

If the specific gravity of portland cement is assumed equal to 3.15 and if the test is carried out in isopropyl alcohol at a constant temperature (72 F. in the present case), Stokes' law may be written

$$d^2 = K\frac{H}{t} \quad \text{(1)}$$

$$\text{where } K = \frac{1{,}837{,}000\,U}{P_1 - P_2} \quad \text{(2)}$$

and is a constant. The density and viscosity of isopropyl alcohol at the temperature of 72 F. were determined and found to be 0.784 g. per cu. cm. and 0.0226 poise, respectively. K then equals 17,550.

Values of d equal to 50, 20, 10, 5, and 2 μ were selected as the diameters for which the weight percentages would be determined since this range of sizes covers rather well the normal distribution of portland cement. The time intervals were also selected so as to be integers and to allow a determination to be made within 6 hr. The time intervals used are 2 min., 10 min., 30 min., 1 hr. 30 min., and 6 hr. With these values of d and t thus selected, the depths H were calculated from Eq. 1. The first three columns of Table I give the values of particle diameters, sedimentation intervals, and settling depths. The stem of a 10-ml. pipette was graduated for the five depths, and the corresponding d values were etched above each line. The graduations were made such that the pipette is inserted until the line is at the top of the meniscus. Corrections for rise of the suspension level upon insertion of the pipette and fall of the level when the pipette is filled were also allowed for in the graduations. These corrections which were added to the H values of Table I depended, of course, upon the dimensions of the pipette and sedimentation cylinder. The actual distances from the pipette tip to the 50, 20, 10, 5, and 2 μ graduations were 17.78, 14.31, 10.85, 8.23, and 5.41 cm., respectively. A drawing of the pipette is shown in Fig. 1.

TABLE I.—CONSTANTS FOR SPECIAL PIPETTE.

Particle Diameters, μ	Sedimentation Intervals	Depths, cm.	Sedimentation Intervals, sec.
50	2 min.	17.09	0.00684 K
20	10 min.	13.68	0.0342 K
10	30 min.	10.26	0.1026 K
5	1 hr. 30 min.	7.69	0.3076 K
2	6 hr.	4.92	1.230 K

For the specified conditions of test, then, it is only necessary to take samples from the depths as marked on the pipette at the stated time intervals in order to obtain the particle size distribution of portland cement.

If it is desired to use a determined specific gravity of the cement, or if the test may be more conveniently carried out at a temperature other than the calibration temperature, sedimentation intervals should be calculated from the factors in the fourth column of Table I, after first computing K from Eq. 2. The calibrated pipette may also be used for other materials suspended in isopropyl alcohol or other mediums provided the time intervals are calculated from the factors of Table I. Additional pipettes, however, could be easily calibrated for the determination of the particle size distribution of other materials.

Procedure

The procedure used in analyzing portland cement with the special pipette is briefly as follows:

1. Weigh out a 10-g. sample of the cement to be tested, and place it, together with 250 ml. isopropyl alcohol (c.p. 99 per cent), in a 500-ml. glass-stoppered graduate. Add the deflocculating agent. As indicated later in this paper, 20 mg. of anhydrous calcium chloride per liter of alcohol was found to be a good deflocculating agent. This amount of calcium chloride may be conveniently obtained by taking 2 ml. of a 0.5 per cent stock solution of calcium chloride in isopropyl alcohol.

2. Disperse the sample thoroughly. A motor-driven brush appears to be effective. The one in use is $1^5/_8$ in. in diameter by $2^1/_4$ in. long, and turns at 1700 rpm. The shaft is, of course, long enough to allow the brush to reach to the bottom of the graduate. A brushing period of 5 min. has been found to be sufficient.

3. Rinse the brush and then add isopropyl alcohol until the total volume of the suspension is 500 ml.

4. Place the cylinder in a constant temperature water bath and allow it

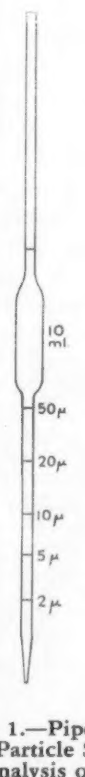

Fig. 1.—Pipette for Particle Size Analysis of Portland Cement.

to remain there until the temperature of the suspension is 72 F.

5. Bring the suspension to uniformity by inverting and righting the cylinder at the rate of about one oscillation per second for a period of at least 1 min. Before beginning the oscillations it is advisable to invert the cylinder and shake it vigorously in order to loosen the sediment which has collected on the bottom.

6. When the cylinder is righted for the last time and placed in the water bath, start a stop watch signifying the beginning of the sedimentation intervals.

7. About 20 sec. before the first sedimentation interval has elapsed, insert the pipette to the 50 μ graduation. The top of the pipette should be kept closed until the tip of the pipette is at the correct depth. It has been found convenient to have a holder for the pipette supported on a ring stand in order not to jar the sedimentation cylinder.

8. As soon as the first time interval has elapsed, fill the pipette rapidly (10 to 15 sec.) with a uniform suction.

9. Transfer the 10 ml. of suspension from the pipette to a weighed 50-ml. Pyrex beaker. Rinse the pipette with isopropyl alcohol and add the rinsings to the beaker.

10. Evaporate the alcohol by placing the beaker on a hot plate or in an oven. After the beaker has cooled in a desiccator, weigh it on a balance sensitive to 0.1 mg.

11. Calculate the percentage of particles less than 50 μ in diameter.

$$\text{Weight percentage} = \frac{\text{weight of residue}}{\text{weight of material in 10 ml. original suspension}} 100 = \frac{\text{weight of residue}}{0.2} 100 = \frac{\text{weight of residue}}{2} 1000$$

12. Repeat 7, 8, 9, 10, and 11 for particles of diameters less than 20, 10, 5, and 2 μ.

Specific Surface

When the particle size distribution of a cement is known, the specific surface—that is, surface area in square centimeters per gram—is readily calculated. The specific surface of particles of diameter d microns is equal to $60{,}000/dP_1$.* Assuming that the maximum size particles in portland cement are 100 μ in diameter, and taking the average particle size of a fraction to be equal to the average of the limiting sizes, the specific surface of the cement may be calculated from the equation

$$S = \frac{600}{3.15}\left(\frac{W\%\ 100-50}{75} + \frac{W\%\ 50-20}{35} + \frac{W\%\ 20-10}{15} + \frac{W\%\ 10-5}{7.5} + \frac{W\%\ 5-2}{3.5} + \frac{W\%\ 2-0}{1}\right) \ldots\ldots (3)$$

where

S = specific surface of the cement in square centimeters per gram,

$W\%$ 100 − 50 = percentage weight of particles over 50 μ in diameter,

$W\%$ 50 − 20 = percentage weight of particles between 50 and 20 μ in diameter,

and so forth for the other fractions.

* The surface area of a particle of diameter d microns is $\pi d^2/10^8$ sq. cm., and the weight of such a particle is $\pi d^3 P_1/6 \times 10^{12}$ g. Therefore, the specific surface is equal to $\frac{\pi d^2}{10^8} \Big/ \frac{\pi d^3 P_1}{6 \times 10^{12}}$ which equals $\frac{60{,}000}{dP_1}$.

It should be pointed out that the specific surface value obtained from particle size distribution depends upon the number and limits of the fractions used in the calculation. The fractions under 10 μ are especially important in this respect. For example, the specific surface of a certain cement was calculated to be 2880 sq. cm. per g. by using Eq. 3, but when the fractions used in calculating were 100-50, 50-20, 20-10, 10-5, and 5-0, the specific surface value was determined as 2440 sq. cm. per g.

Test Results

Lea and Nurse (*4*) used 16 mg. anhydrous calcium chloride per liter of ethyl alcohol as a deflocculating agent in their study of portland cements with the Andreasen pipette. Calcium chloride was tried as a deflocculating agent for use with ispropyl alcohol, and, as it appeared to be effective, a series of tests was made in which the amount of calcium chloride was varied from 10 mg. to 50 mg. per liter alcohol. Over this range of concentrations of calcium chloride, there was apparently little difference in the effectiveness of the deflocculation. Some tests were also made using the sodium salt of fluorescein as the deflocculating agent. (This agent is suggested by Klein (*10*) for use in a hydrometer method.) The results indicated that the sodium salt of fluorescein was about as effective an agent as calcium chloride. Some of the results obtained by using various amounts of the deflocculating agents are given in Table II.

TABLE II.—VARIATION OF DEFLOCCULATING AGENT.

Cement	Deflocculating Agent	Percentage Weight Finer than				
		50 μ	20 μ	10 μ	5 μ	2 μ
A.........	None	94.3	57.3	27.4	11.1	1.9
	20 mg. $CaCl_2$ per liter	94.4	58.2	31.8	15.6	3.2
	Na salt fluorescein	95.1	57.9	32.2	15.9	3.0
B.........	None	99.4	80.0	51.5	28.9	9.3
	10 mg. $CaCl_2$ per liter	99.6	80.6	51.7	29.4	9.7
	20 mg. $CaCl_2$ per liter	99.8	80.3	52.0	29.2	9.9
	50 mg. $CaCl_2$ per liter	99.5	80.7	51.7	29.3	10.1
C.........	None	89.0	59.2	3.3	1.3	...
	20 mg. $CaCl_2$ per liter	88.8	53.9	32.8	19.1	6.5
	50 mg. $CaCl_2$ per liter	89.2	54.3	32.8	18.8	6.6
	Na salt fluorescein	88.7	54.1	33.0	18.9	6.5
D.........	None	95.7	59.2	29.1	13.8	3.2
	10 mg. $CaCl_2$ per liter	96.1	60.0	34.3	18.3	4.7
	20 mg. $CaCl_2$ per liter	95.5	59.5	33.7	18.3	4.9
	50 mg. $CaCl_2$ per liter	95.2	59.6	33.6	18.1	5.0

In connection with deflocculating agents, it might be mentioned that two determinations were made using absolute ethyl alcohol as the suspending medium and the results compared to those obtained for the same cements when the determinations were made with isopropyl alcohol. The same pipette was used for the ethyl alcohol determinations, but, of course, it was necessary to calculate the sedimentation intervals from the factors given in Table I. The results are shown in Table III. It will be noted that the weight percentages by the determinations with ethyl alcohol are somewhat higher than those with isopropyl alcohol. This result, that the determination with the liquid of the lower viscosity gives higher values for weight percentages, has been obtained by other investigators comparing methyl alcohol and

TABLE III.—VARIATION OF SUSPENDING MEDIUM.

Cement	Suspending Medium	Percentage Weight Finer than				
		50 μ	20 μ	10 μ	5 μ	2 μ
I.........	Isopropyl alcohol	88.8	53.9	32.8	19.1	6.5
	Ethyl alcohol	89.1	54.5	33.4	19.6	7.2
II.........	Isopropyl alcohol	89.4	53.1	32.3	19.2	7.3
	Ethyl alcohol	90.1	53.7	33.0	19.8	7.7

amyl alcohol (*11*) and comparing methyl alcohol and ethyl alcohol (*12*) for particles 15 μ and less in diameter.

In Table IV are given results of tests made, using the outlined procedure, to determine the reproducibility of the special pipette method. Duplicate determinations made on each of four cements show that the method does give consistent results.

TABLE IV.—REPRODUCIBILITY OF PIPETTE ANALYSES.

Cement	Percentage Weight Finer than				
	50 μ	20 μ	10 μ	5 μ	2 μ
a	92.9	53.8	29.3	14.5	3.3
	93.2	53.6	29.4	14.7	3.3
b	99.8	65.9	35.0	19.0	6.1
	99.7	66.1	35.3	19.1	6.3
c	89.5	53.1	32.4	19.2	7.3
	89.2	53.1	32.2	19.1	7.3
d	90.8	49.7	30.2	18.2	7.5
	90.6	49.7	30.1	18.3	7.5

The results of pipette analyses made on 21 portland cements obtained from mills located in widely separated parts of the United States are given in Table V. Determinations by the Wagner turbidimeter and by the air permeability method are also included in the table for comparison. The No. 325 sieve analyses and the specific surfaces by the Wagner turbidimeter were made in accordance with the A.S.T.M. Standard Method of Test for Fineness of Portland Cement by Means of the Turbidimeter (C 115–42).[3] Specific surface values from the pipette analyses were calculated using Eq. 3. The apparatus which was used in making the air permeability determinations is similar to the ones used by Lea and Nurse (*4*) and by Blaine (*13*); specific surface values were calculated from the equation given by Lea and Nurse. Air permeability determinations were carried out with the bed of cement compacted to approximately the same degree in each case, as measured with a standard Vicat apparatus (*14*). The large end of the movable rod, 1 cm. in diameter, was allowed to drop through a distance of 2 cm., measured from the surface of the bed, onto the bed of material which had previously been formed in the permeability cell. The penetration of the plunger in millimeters, designated as the index of compaction, was between 1.7 and 2.2 for all of the tests.

In every case the specific surface value by the pipette analysis lies between the values determined by the turbidimeter and by air permeability. It was to be expected that

[3] 1942 Book of A.S.T.M. Standards, Part II, p. 47.

TABLE VI.—EFFECTIVE APERTURE OF NO. 325 SIEVE BASED ON PIPETTE ANALYSIS.

Cement	Aperture, μ
No. 1	53
No. 2	55
No. 3	56
No. 4	55
No. 5	54
No. 6	55
No. 7	56
No. 8	54
No. 9	55
No. 10	56
No. 11	58
No. 12	55
No. 13	54
No. 14	55
No. 15	49
No. 16	55
No. 17	49
No. 18	55
No. 19	56
No. 20	55
No. 21	52
Average	54

the values by the turbidimeter would be lower than those by pipette analyses, because the turbidimeter measures only down to particles of 7.5 μ in diameter. It is also admitted that the values of specific surface calculated from Eq. 3 are lower than the true surface since spherical particles are assumed. Also, if the pipette analyses were carried down to particles of smaller diameters than 2 μ, the specific surface values would probably be still higher. It appears then that the values of specific surface from air permeability measurements may be nearer the true values than those obtained by the Wagner turbidimeter or by the special pipette method. However, the turbidimeter and pipette give values of specific surface which are in relative agreement with each other and with the air permeability method, and so are useful in comparing the fineness of cements.

The data from the pipette analyses for the cements of Table V were plotted, weight percentages finer (to a linear scale) against particle diameters (to a log scale), and the resulting curves were slightly extrapolated to the percentages passing the No. 325 sieve. It was then possible to obtain a sedimentation particle diameter corresponding to the maximum size particle passing the No. 325 sieve. The values thus obtained are listed in Table VI. It will be noted that the average effective aperture of the No. 325 sieve was found to be 54 μ. This is in good agreement with the value of 53 μ suggested by Schweyer and Work (*15*).

From the data of Table V for the Wagner turbidimeter

TABLE V.—COMPARISON OF FINENESS DETERMINATIONS BY VARIOUS METHODS.

Cement	Type	Per Cent Passing No. 325 Sieve	Pipette Analysis, Percentage Weight Finer than					Specific Surface, sq. cm. per g.		
			50 μ	20 μ	10 μ	5 μ	2 μ	Pipette Analysis	Wagner Turbidimeter	Air Permeability
No. 1	Normal	96.1	94.6	59.0	35.8	20.9	7.3	3010	2250	3960
No. 2		87.8	83.9	51.3	31.7	18.4	5.9	2610	2000	3660
No. 3	Modified	91.6	88.8	55.9	34.5	19.9	5.2	2630	2090	3900
No. 4		92.5	89.5	55.3	33.7	18.6	4.2	2460	2020	3710
No. 5		91.8	89.4	53.1	32.3	19.2	7.3	2860	1930	3860
No. 6		95.4	93.0	53.7	29.4	14.6	3.3	2160	1800	3160
No. 7		91.3	87.5	52.6	31.8	17.8	4.9	2480	1980	3750
No. 8		96.9	95.6	56.2	29.6	14.1	3.3	2170	1870	2990
No. 9		96.7	94.4	58.2	31.8	15.6	3.2	2240	1960	3340
No. 10		97.4	95.5	59.5	33.7	18.3	4.9	2590	2130	3680
No. 11		92.8	88.1	52.3	32.0	18.8	5.8	2630	2100	3830
No. 12		88.8	85.4	52.8	32.6	19.0	5.5	2600	2020	3830
No. 13		88.0	85.5	55.2	34.2	19.4	5.7	2680	2030	3620
No. 14		95.1	92.5	53.0	29.0	15.1	4.5	2330	1960	3380
No. 15	High early strength	99.5	99.8	80.3	52.0	29.2	9.9	3980	2850	5460
No. 16	Low heat	94.2	90.7	49.7	30.2	18.2	7.5	2810	2000	3540
No. 17		99.4	99.7	66.1	35.3	19.1	6.3	2880	2250	4010
No. 18		93.4	90.4	55.1	32.4	18.7	5.3	2590	2080	3710
No. 19		93.6	90.1	53.6	29.8	14.8	3.3	2160	1850	3030
No. 20		92.2	88.8	53.9	32.8	19.1	6.5	2760	2010	3650
No. 21	Sulfate resistant	97.7	96.8	59.8	33.8	16.2	4.2	2440	2060	3450

TABLE VII.—COMPARISON OF SPECIFIC SURFACE VALUES BY WAGNER TURBIDIMETER AND PIPETTE ANALYSIS COMPUTED TO COMMON BASIS.

Cement	Specific Surface, sq. cm. per g.		Ratio, Pipette to Wagner Turbidimeter
	Pipette	Wagner Turbidimeter	
No. 1	2100	2200	0.95
No. 2	1890	1980	0.95
No. 3	2020	2060	0.98
No. 4	1980	1990	0.99
No. 5	1940	1900	1.02
No. 6	1820	1750	1.04
No. 7	1900	1960	0.97
No. 8	1840	1800	1.02
No. 9	1930	1900	1.02
No. 10	2020	2080	0.97
No. 11	1920	2070	0.93
No. 12	1930	1990	0.97
No. 13	1990	2010	0.99
No. 14	1810	1910	0.95
No. 15	2780	2800	0.99
No. 16	1860	1950	0.95
No. 17	2130	2160	0.99
No. 18	1950	2030	0.96
No. 19	1820	1800	1.01
No. 20	1950	1970	0.99
No. 21	2000	2000	1.00
Average			0.98

analyses and the pipette analyses, specific surface values were recalculated to a common basis (fractions of particle diameters 100 μ to 50 μ, 50 to 20, 20 to 10, 10 to 7.5, and 7.5 to 0). The results by the two methods were then in good agreement as is shown by Table VII. The ratios of values by the pipette analyses to those by the turbidimeter analyses varied from 0.93 to 1.04 with an average of 0.98.

Summary

A pipette method for determining the particle size distribution of portland cement has been described. The pipette used was especially calibrated so that the weight percentages of the cement finer than particle diameters of 50, 20, 10, 5, and 2 μ are obtained directly from the sample residues. As portland cement is ordinarily about 90 per cent finer than particle diameters of 50 μ and 5 per cent finer than particle diameters of 2 μ, the method covers well the normal distribution. The equipment required other than an analytical balance is simple and inexpensive.

Duplicate tests made on several cements indicated that results by the special pipette method are reproducible. Specific surface values calculated from the pipette analyses of 21 cements were compared to values obtained by air permeability measurements and to values obtained by the Wagner turbidimeter. From the No. 325 sieve analyses and the pipette analyses on these 21 cements the average effective aperture of the No. 325 sieve was indicated to be 54 μ. Specific surface values from the pipette analyses and from the Wagner turbidimeter determinations were in good agreement when calculations were made on a common basis.

References

(*1*) Symposium on New Methods for Particle Size Determination in the Subsieve Range, Washington Spring Meeting, Am. Soc. Testing Mats. (1941).

(*2*) C. A. Hogentogler and E. A. Willis, "Subgrade Soil Testing Methods," *Proceedings*, Am. Soc. Testing Mats., Vol. 34, Part II, p. 693 (1934)

(*3*) C. E. Jackson and C. M. Saeger, Jr., "Use of the Pipette Method in the Fineness Test of Molding Sand," *Journal of Research*, Nat. Bureau Standards, Vol. 14, p. 59 (1935).

(*4*) F. M. Lea and R. W. Nurse, "The Specific Surface of Fine Powders," *Journal*, Soc. Chemical Industry, Vol. 58, p. 277 (1939).

(*5*) L. A. Wagner, "A Rapid Method for the Determination of the Specific Surface of Portland Cement," *Proceedings*, Am. Soc. Testing Mats., Vol. 33, Part II, p. 553 (1933).

(*6*) W. O. Hinkley, "Determination of Particle Size Distribution," *Industrial and Engineering Chemistry*, Analytical Edition, Vol. 14, p. 10 (1942).

(*7*) E. E. Bauer, "A Study of Deflocculating Agents Used in the Particle Size Determination of Soils," *Proceedings*, Am. Soc. Testing Mats., Vol. 38, Part II, p. 575 (1938).

(*8*) E. E. Bauer, "Mechanical Analysis of Soils," *Proceedings*, Purdue Conference on Soil Mechanics and Its Applications, September, 1940, p. 161.

(*9*) S. W. Martin, "The Determination of Subsieve Particle Size Distribution by Sedimentation Methods," Symposium on New Methods for Particle Size Determination in the Subsieve Range, p. 66, Washington Spring Meeting, Am. Soc. Testing Mats. (1941).

(*10*) Alexander Klein, "An Improved Hydrometer Method for Use in Fineness Determinations," *Proceedings*, Am. Soc. Testing Mats., Vol. 41, p. 953 (1941); Symposium on New Methods for Particle Size Determination, p. 52, Washington Spring Meeting, Am. Soc. Testing Mats. (1941).

(*11*) P. S. Hakanson, "On Determination of Particle Size Distribution in Cement," Report submitted by the Swedish Subcommittee on Special Cements for the meeting in London of the International Subcommittee on Special Cements for Large Dams, April 16, 1937.

(*12*) F. M. Lea, "Comparative Tests on the Fineness of Cements," *Journal*, Soc. Chemical Industry, Vol. 58, p. 146 (1939).

(*13*) R. L. Blaine, "Studies of the Measurement of Specific Surface by Air Permeability," ASTM Bulletin, No. 108, January, 1941, p. 17.

(*14*) G. E. Monfore, "Studies of the Air Permeability Method for Determining Specific Surface," *Report Ce 34*, U. S. Bureau of Reclamation Cement Laboratory, Denver, Colo., December 8, 1941.

(*15*) H. E. Schweyer and L. T. Work, "Methods for Determining Particle Size Distribution," Symposium on New Methods for Particle Size Determination in the Subsieve Range, p. 1, Washington Spring Meeting, Am. Soc. Testing Mats. (1941).

Walker Fellowship in the Sand and Gravel Industry

The University of Maryland, in cooperation with the National Sand and Gravel Association, offers a fellowship for research on appropriate problems related to the sand and gravel industry. It is designated as the Stanton Walker Fellowship. Fellows enter upon their duties on July 1, and continue for 24 months, including one month each year for vacation. The Fellowship amounts to $600 for the year and is paid in twelve monthly installments. Opportunity for an increase in stipend is offered those fellows demonstrating more than average capability and interest in the research work.

The holder of the Fellowship will register in the Graduate School of the University of Maryland. Class work will be directed by the heads of the departments of instruction. About half time will be spent in research work. The faculty supervisor will be the Professor of Civil Engineering of the University of Maryland.

This fellowship is open to graduates in engineering, from an accredited college or university, who are qualified to undertake graduate study and research work leading to a Master's degree.

Applications for this fellowship will be received up to M[illegible] 1, 1943, and forms for this purpose may be secured by writing to the Dean of the Graduate School, University of Maryland, College Park, Maryland.

Standard Samples Issued or in Preparation

A complete list of the Standard Samples issued or in preparation by the National Bureau of Standards has been included in a 16-page booklet supplementing the NBS Circular C 398, this Supplement being dated October 28, 1942. It gives general information about this work. A descriptive list of the various samples covers steels, iron, steel-making alloys, non-ferrous alloys, ores, ceramic materials, microchemical standards, chemicals, melting-point standards, fineness standards and thermoelectric standards. In addition there is given a summary of analyses of the various samples, these data being given primarily as a guide for purchasers. Copies of this Supplement to Circular C 398 can be obtained without charge from the Government Printing Office or from the Bureau.

Federal and A.S.T.M. Reinforcement Bar Requirements Coordinated

By recent action of the Federal Specifications group, Emergency Alternate Federal Specifications for reinforcement bars for concrete have been issued which provide that for each A.S.T.M. grade there is a corresponding grade in the Federal Specifications. Subcommittee V of A.S.T.M. Committee A-1 on Steel took action this past year to increase the raw material sources for reinforcing bars by adding to A.S.T.M. Specifications A 160 – 39 (Axle-Steel Concrete Reinforcement Bars) the emergency alternate provisions permitting use of "either new or used steel material of sound character suitable for reinforcement bars such as billets, bars, shafting, or structural shapes." The emergency revision applied to all three A.S.T.M. grades of axle-steel bars, namely, structural, intermediate, and hard.

In making corresponding revisions in Federal Specification QQ-B-71a, the provisions for use of these additional raw materials were applied, as in A.S.T.M., to bars from car axles known as Grade 3 (Intermediate, Car-Axle-Steel). But, inasmuch as the Federal Specification, at that time, recognized only one grade (intermediate) of axle-steel bars, the scope of the Federal revision failed to cover the use of the emergency materials for structural and hard grade bars.

The full emergency provisions are now contained in a revision of Federal Specification E-QQ-B-71a effective December 9, 1942. The result is that Federal Specifications for reinforcing bars now conform in scope and manufacture to the combined A.S.T.M. Specifications A 15, A 16, and A 160.

A comparison of the A.S.T.M. grades and Federal Specification grades follows:

A.S.T.M. Grade	Federal Specification Grade	
A15 Billet Steel, Structural	E-QQ-B-71a	Grade 1
A15 Billet Steel, Intermediate	E-QQ-B-71a	Grade 2
A15 Billet Steel, Hard	E-QQ-B-71a	Grade 4
A16 Rail Steel (Hard Only)	E-QQ-B-71a	Grade 5
A160 Axle-Steel, Structural*	E-QQ-B-71a	Grade 6*
A160 Axle Steel, Intermediate*	E-QQ-B-71a	Grade 3*
A160 Axle-Steel, Hard*	E-QQ-B-71a	Grade 7*

* Subject to emergency provisions.

A.S.T.M. in W.P.B. Orders

Many of the specifications and tests issued by the Society are being referred to or incorporated in other ways in orders emanating from the War Production Board. Recent orders which refer to A.S.T.M. are the rubber control orders M-15-b and M-15-b-1. The latter set up complete specifications for the manufacture of some 31 classes of products. Some of the products covered include compounds for mechanical rubber products, a large number of types of hose, packing, rubber-lined tanks, brake linings and clutch facings, footwear, insulated wire and cable, etc.

According to the magnesium allocation order M-2-b, an amendment requires more strict segregation of scrap by owners or generators, scrap now to be segregated in accordance with A.S.T.M. alloy designations, except that alloys Nos. 4 and 17 may be mixed with each other.

Another order in which reference is made to A.S.T.M. specifications concerns the Conservation Order M-11-b applying to zinc in which the definition of "Prime western zinc" is set up to mean zinc with no higher grade than that conforming to A.S.T.M. Specifications B 6 – 37, grade 5, while "zinc of any other grade" means zinc conforming to A.S.T.M. Specifications B 6 – 37, grades 1a, 1, 2, 3, or 4, and any alloy in the composition of which the percentage of zinc metal by weight equals or exceeds the percentage of all other metals. This order was dated November 26 and became effective on November 30.

Steel for Test Purposes

To encourage further use of plain carbon steel and the new National Emergency Alloy Steels, the War Production Board has renewed an arrangement started three months ago by which sample quantities of steels for experimental purposes can be delivered to manufacturers or laboratories, without regard to preference ratings.

Any manufacturer or laboratory wishing to obtain samples of steel under this arrangement is asked to certify on the purchase order that such steel is to be used in making tests; that quantities ordered, added to amounts already received or on order from other sources, will not amount to more than 1000 lb. of each composition; and that the total amount of all compositions of such steel on hand or ordered from all sources for testing purposes does not exceed 3000 lb. This limitation is for the first quarter of 1943.

A letter granting permission to supply sample lots of steel on this basis was sent December 31, 1942, to all alloy steel makers reporting to the WPB Steel Division on Form PD-391 and to a separate list of carbon steel mills.

The arrangement covers all plain carbon steels and the National Emergency Alloy Steels described in Data Sheet No. 182, dated December 17, 1942, published by the American Iron and Steel Institute. Any steel mill not included in the original mailing list can secure permission to obtain sample lots of steel by writing to the WPB Steel Division.

There are some significant changes in the steels covered by these provisions as compared with previous lists. Carbon steels have been included for the first time to make it convenient to obtain samples of these materials for testing in applications where alloy steels have previously been used.

The NE 8600 series, which formerly had not been made with more than 0.30 per cent mean carbon content, has now been extended to include steels of higher carbon content up to 0.50 per cent. The nickel ranges have been increased to 0.40 to 0.70 per cent and 0.20 to 0.50 per cent in the NE 8600 and 9400 series, respectively. NE 6022, 8339, and 8949 have been discontinued, and the NE 8700 series has been deleted with the exception of the NE 8720 low carbon carburizing grade.

These changes have been prompted by, and are directed primarily toward, the conservation of molybdenum and a more effective utilization of all the alloying elements in the supplies of alloy steel scrap now available.

Annotated Bibliography of Aluminum Cleaning[*,a]

Prepared by Jay C. Harris[1] and Robert B. Mears[2]

The preparation of this Bibliography was undertaken to provide Section G on Metal Cleaners of Subcommittee II on Specifications of the A.S.T.M. Committee D-12 on Soaps and Other Detergents with information regarding existent specifications and methods for cleaning aluminum. Included is pertinent information dealing with the various types of commercial cleaning methods, means for inhibiting corrosion and descriptions of established laboratory techniques for the evaluation of detergents used for cleaning this metal.

(1) *Genie Civil*, Vol. 23, p. 375 (1893).

Taken from a reference in *Engineering and Mining Journal*. This article outlines several methods of aluminum cleaning, including grease removal with organic solvents, acid, and hand finishing. A varnish of turpentine and stearic acid, and a polish of bloodstone is used for polishing.

(2) Maurice de Keghel, "Products for the Maintenance and Cleaning of Metals and Their Manufacture," *Produits Chimie*, Vol. 25, pp. 327–333 (1922); *Journal*, Inst. Metals., Vol. 30, p. 660 (1923).

Processes for polishing and cleaning are divided into the following classes: (1) direct dry hard abrasion, (2) wet soft abrasion, and (3) dry soft abrasion.

(3) R. Seligman and P. Williams, "Cleaning of Aluminum Utensils," *Journal*, Inst. Metals, Vol. 28, pp. 297–298 (1922).

Danger of pitting aluminum while cleaning with soda solutions can be eliminated by adding enough sodium silicate to the soda solution to (*a*) combine with the calcium in the water used, and (*b*) to leave a slight excess of silicate to form a protective coating of colloidal aluminum silicate on the metal. 10 to 12 per cent silicate is required.

(4) "Cleaning and Polishing Aluminum," *Aluminium - Messing - und Kupfer - Waren*, Vol. 5, No. 12, p. 9 (1923); *Journal*, Inst. Metals, Vol. 30, p. 660 (1923).

To obtain a bright white surface the article is dipped for 15 sec. in a hot 10 per cent solution of NaOH saturated with NaCl, washed, dried, and polished. Again immersed in the same solution for about 30 sec. or until gas is evolved, washed, dried. If copper is present, a brown stain is found which is removed by immersion in concentrated nitric acid.

(5) B. Haas, "Preparation of Polishing Pastes for Aluminum," *Aluminium*, Vol. 5, No. 8, pp. 7–10 (1923); *Journal*, Inst. Metals, Vol. 30, p. 660 (1923).

Methods and preparations for polishing.

(6) Rohrig, "Diminishing Attack of Alkali Solutions on Aluminum by the Addition of Water Glass," *Chemiker-Zeitung*, Vol. 47, pp. 528–529 (1923).

Describes in detail tests involving the use of water glass as a corrosion inhibitor in 0.05 per cent quantities at room temperature and at the boil in combination with caustic soda and soda ash. This amount seems to protect adequately with soda ash and with caustic soda at the same concentration.

(7) "Cleaning Aluminum," *Automotive Industry*, Vol. 50, February 14, 1924, p. 353.

It was found by Rohrig that the addition of ½ per cent of water glass to a soda solution reduced or eliminated the solvent action on aluminum.

Suggested by W. Ostwald that aluminum parts of the cooling systems of auto be rendered immune from the solvent action, by filling the system for the first time with weak soda solution containing water glass.

(8) E. M. Baker and R. Schneidewind, "Metal Cleaning with Alkaline Cleaning Solutions," *Transactions*, Am. Electrochemical Soc., Vol. 45, pp. 327–352 (1924); *Chemical Abstracts*, Vol. 18, p. 1439 (1924).

Efficiency of alkaline cleaning solutions determined by measuring the relative interfacial tensions of these solutions and water, and these solutions with a standard mineral oil. Measured industrial soaps, NaOH, trisodium phosphate, sodium carbonate and sodium silicate. According to these results sodium silicate is the most effective.

(9) T. S. Blair, "Prepared Metal Cleaners," *The Metal Industry* (New York), Vol. 22, pp. 488–489 (1924); *Journal*, Inst. Metals, Vol. 34, p. 665 (1925).

Emphasis upon proper cleaner and proper application to conserve time and money.

(10) William Blum and G. A. Hogaboom, "Principles of Electroplating and Electroforming," pp. 125–132, McGraw-Hill Book Co., New York, N. Y. (1924).

General information and some specific formulas for metal cleaning.

(11) H. A. Gardner, "Recent Observations Regarding the Corrosion, Cleansing, and Protection of Aluminum," *Mechanical Engineering*, Vol. 46, pp. 206–207 (1924).

Much is given on the causes of corrosion and protective measures. Aluminum fittings, castings, and motor parts oftentimes must be cleaned. Dipping in benzol gives effective results in many cases but danger is involved in handling such solvents. Combinations of caustic soda, borax and soda ash in hot water in 5 per cent solutions are more effective but may etch the aluminum. Addition of 2 to 3 per cent neutral soap paste to this liquid is proposed and this apparently aids in decreasing corrosive effect of the alkalies. The metal is placed in boiling baths for 5 to 30 min. and then rinsed by flushing. No data on embrittlement was obtained. Sodium silicate is useful in inhibiting attack. Suggests the use of 5 per cent NaOH or soda ash with the addition of not less than 0.5 per cent sodium silicate for cleansing aluminum parts. Addition of a small amount of soap paste might aid.

(12) W. L. Carver, "New Process Is Developed for Cleaning Metal Body Surfaces," *Automotive Industry*, Vol. 54, pp. 148–149 (1926); *Journal*, Inst. Metals, Vol. 39, p. 656 (1928).

Description of the application of a proprietary compound by spray gun method. The compound consists of sienna, powdered charcoal, methylethyl ketone, and phosphoric acid. This mixture is sprayed upon the body surface and when it drops off the body is subjected to an alcohol bath. Leaves the surface clean and neutral with a slight etch.

(13) Jacob Hay, "Cleaning and Preparing of Metals for Enamel," *Monthly Review*, Am. Electroplaters' Soc., Vol. 13, No. 8, pp. 10–14 (1926); *Journal*, Inst. Metals., Vol. 41, p. 630 (1929).

Aluminum die castings should be cleaned with strong sodium hydroxide solution, rinsed in cold water, then dipped in a mixture of three parts of nitric acid and one part sulfuric acid, washed, dried and heated to 400 F. Zinc or galvanized metals should be cleaned first in a weakly alkaline solution, rinsed, and dipped in a solution of 1 lb. copper chloride, 1 lb. copper sulfate, 1 lb. ammonium chloride and 1 lb. hydrochloric acid in 6.4 gal. of water.

(14) "Testing of a Universal Cleaning Reagent," *Jahresberichte*, Chemisch-Technische Reichsanstalt, Vol. 6, pp. 211–212 (1927); *Journal*, Inst. Metals, Vol. 41, p. 631 (1929).

A cleaning reagent comprising 33 per cent water, 56 per cent sodium bicarbonate, 10 per cent soft soap, and small amounts of sodium carbonate, glycerine and traces of iron and aluminum oxides has no harmful effect on aluminum.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

*This paper also appears in the A.S.T.M. Standards on Soaps and Other Detergents, p. 107. (Issued as separate publication.) The same type is being used in this BULLETIN.

[a] There are several Armed Forces specifications which are pertinent to this bibliography, but these cannot be abstracted for reasons pertaining to national defense.

[1] Chairman, Section G on Metal Cleaners, Subcommittee II on Specifications, Committee D-12 on Soaps and Other Detergents; Monsanto Chemical Co., Dayton, Ohio.

[2] Metallurgical Division, Aluminum Research Laboratories, Aluminum Company of America, New Kensington, Pa.

(15) P. H. Groggins and Walter Scholl, "Ortho-dichlorbenzene—an Excellent Cleaner for Metals," *Industrial and Engineering Chemistry*, Vol. 19, pp. 1029–1030 (1927); *Chemical Abstracts*, Vol. 21, p. 3426 (1927).

Ortho-dichlorbenzene can be used unmodified or as a paste in five parts to one part of precipitated chalk. It acts as a solvent for oxides of nickel, silver, copper and aluminum, and has negligible action on the metals.

(16) Edgar T. Painton "The Working of Aluminum", p. 210, Chapman & Hall, Ltd., London (1927); *Bulletin No. 3*, Mellon Institute of Industrial Research. A Select, Annotated Bibliography of the Hygienic Aspects of Aluminum and Aluminum Utensils.

The dark film occasionally obtained upon boiling certain kinds of water in aluminum utensils is thought to be due to the small percentage of iron impurities in the metal acting in conjunction with the impurities in the water. This film may be removed by boiling with a dilute acetic acid solution or fruit juices.

(17) "Practical Industrial Metal Cleaning," *Black and White*, Vol. 1, No. 3, pp. 36–38; No. 4, pp. 28–30 (1928); *Journal*, Inst. Metals, Vol. 40, p. 702 (1928).

Discussion of the general technique in immersion cleaning of metal parts.

(18) D. J. Benoliel, "Growth of Industrial Cleaning. The History, Chemistry and Mechanism of Metal Cleaners," *The Metal Industry* (New York), Vol. 26, pp. 79–80, 121–123 (1928); *Journal*, Inst. Metals, Vol. 41, p. 630 (1929).

Lists the variety of cleaning jobs based upon the metals involved.

(19) G. E. Heron, "Cleaning Sheet Metal to Be Finished," *Industrial Finishing*, Vol. 4, pp. 107–108, 110 (1928); *Journal*, Inst. Metals, Vol. 40, p. 702 (1928).

Discussion of the troubles caused by improper cleaning and explains how to keep cleaning solutions and rinses in first class condition.

(20) "Tests on Aluminum Cleaning Methods," *Jahresberichte*, Chemisch-Technische Reichsanstalt, Vol. 8, pp. 182–183 (1929); *Journal*, Inst. Metals, Vol. 47, p. 235 (1931).

The addition of chromate or silicate to strongly alkaline cleansers of aluminum prevents corrosion.

(21) F. J. Gavin, "Cleaning Aluminum for Decorating Purposes," *Metal Cleaning and Finishing*, Vol. 1, No. 7, November, 1929, pp. 585–586.

Aluminum sheet is coated with oil for shipping purposes, hence, cannot be successfully decorated until cleaned. The average decorator can easily remove the oil by placing any good hydrocarbon thinner or turpentine substitute in the fountain of his coating machine. Apply a heavy coat of this to the composition roller, leave off the bottom scraper bar to permit the thinners to coat on the bottom of the plates and then pass the sheets through the automatic oven for 15 min. at 500 to 550 F., after which the metal will be found to be lithographically clean.

(22) O. F. Hunziker, W. A. Cordes, and B. H. Nissen, "Metals in Dairy Equipment—Corrosion Caused by Washing Powders, Chemical Sterilizers, and Refrigerating Brines," *Journal of Dairy Science*, Vol. 12, pp. 252–284 (1929).

Nineteen different metals, plated metals and metal alloys were tested. Aluminum and a manganese alloy of aluminum containing 1.25 per cent manganese were among those tested. The alkalies tested were a special alkali (35 per cent NaOH, 62 per cent Na_2CO_3), sodium carbonate, Wyandotte (49 per cent Na_2CO_3, 36 per cent $NaHCO_3$), trisodium phosphate, tin cleaner, Diversol and NaOH. Chemical sterilizers were sodium hypochlorite, Diversol, and Chloramine-T. The test comprised partial immersion of the metal strips in solutions in closed Mason jars for 5 hr. at 150 F. for alkalies and 5 days at 70 F. for chemical sterilizers. Used 0.5 per cent solutions of alkalies. Found that the addition of 0.025 per cent sodium chromate to 0.5 per cent solution of trisodium phosphate in water very greatly reduced corrosion. With 0.5 per cent solutions of alkalies the addition of sodium silicate in 0.05 per cent quantities did not reduce the attack of NaOH and trisodium phosphate but completely eliminated corrosion by soda ash. For tin coated equipment the use of trisodium phosphate solution (0.16 to 0.5 per cent) combined with 0.025 per cent sodium chromate is best.

(23) "Cleaning Method for Aluminum Castings," *Metallbörse*, Vol. 20, February, 1930, p. 428.

The following method is recommended for the removal of oil, dirt and finger marks from aluminum castings: The casting is placed in the usual hot (90 C.) alkaline cleaning solution until the surface begins to tarnish. It is then removed, washed in cold water and dried. The casting is then placed for a few seconds in a cold solution of a mixture of two parts concentrated nitric acid and one part concentrated sulfuric acid. It is then rinsed in cold water and then in boiling water. A small amount of borax soap (about 8 g. per liter) is generally added to the hot water bath in order to remove the last traces of acid and to prevent spotting and finger prints.

(24) "Preparation of Sheet Metal for Painting," *Bulletin No. 16*, Am. Chemical Paint Co., Ambler, Pa., 15 pp., August, 1930.

The whole paper is given over to the preparation of sheet metal preparatory to painting, and discusses the Deoxidine Process. Deoxidine is a cleaning liquid made up of phosphoric acid, wetting agents and other additions.

(25) "Removing Metal Scale," *Ceramic Industry*, Vol. 14, p. 552 (1930); *Journal*, Inst. Metals, Vol. 50, p. 578 (1932).

A method is described for electrochemical means for descaling while at the same time protecting the metal from hydrogen embrittlement, in which a metal is co-deposited upon the work when the scale is removed.

(26) "Sodium Metasilicate for Metal Cleaning," *Brass World*, Vol. 26, p. 248 (1930); *Journal*, Inst. Metals, Vol. 47, p. 50 (1931).

The superiority of sodium metasilicate for nearly all metal cleaning purposes is described.

(27) "Electrolytic Metal Cleaning Without Corrosion," *Chemical and Metallurgical Engineering*, Vol. 37, pp. 634–635 (1930); *Journal*, Inst. Metals, Vol. 47, p. 118 (1931).

The Bullard-Dunn electrolytic process in which a metal film is deposited on the metal to be cleaned the instant each particle of scale is removed. The film is a metal, resistant to the acid bath, such as lead, tin or zinc.

(28) W. F. Cahill, "Preparation of Metals for Finishing," *Monthly Review*, Am. Electroplaters' Soc., Vol. 17, No. 1, pp. 24–26 (1930); *Journal*, Inst. Metals, Vol. 43, p. 672 (1930).

Hints on the removal of grease and stains by means of the tumbling barrel and electrolytic cleaning baths.

(29) Julius Fischer, "Cleaning of Metal Parts—I. Dry Cleaning," *Werkssleitr.*, Vol. 4, pp. 53–55, 127–131 (1930); *Journal*, Inst. Metals, Vol. 47, iii, p. 50 (1931).

Mechanical methods of cleaning are discussed.

(30) M. Freyman, "Cleanser for Aluminum Vessels," *Petit Journal du Brasseur*, p. 774 (1930); *Brewing Trade Review*, Vol. 44, p. 452 (1930); *Journal* Inst. Brewing, Vol. 36, p. 512 (1930); *Journal*, Inst. Metals, Vol. 47, March, 1931, p. 166.

Discusses the removal of beer scale from aluminum surfaces. Used washing soda and water glass. This treatment is not always successful. Prior to the use of the above treatment control corrosion tests were made in the laboratory.

(31) A. K. Graham, "Industrial Cleaning of Metal," *Monthly Review*, Am. Electroplaters' Soc., Vol. 17, No. 1, pp. 4–10 (1930); *Journal*, Inst. Metals, Vol. 43, p. 672 (1930).

General discussion of metal cleaning.

(32) R. W. Mitchell, "Cleaning Aluminum," *The Metal Industry*, Vol. 28, pp. 171–172 (1930).

The amphoteric nature of aluminum is pointed out. Many aluminum alloys contain some metal electro-negative to aluminum such as copper, iron, or nickel. Segregation of these produces an opportunity for galvanic action which show themselves by pitting and hydrogen evolution. Alloys containing silicon also are subject to attack, as silicon and silicides dissolve readily in hot alkaline solutions.

Soluble silicates and chromates are useful for preventing corrosion. This effect is attributable to a thin layer of insoluble aluminum silicate in one case and the deposition of a similar thin

layer of insoluble chromate in the other. Also, it is possible in the latter case that an insoluble chromite or chromic aluminate is formed.

In strongly alkaline solutions chromates are ineffective and it is said that their effect is retardant rather than inhibitive. On zinc and tin the chromates are more effective.

The amount and kind of silicate is important. The more alkaline ones do not protect well, and those too high in silica form a heavy, difficultly rinsable film. Such a deposit is unsightly and may result in alteration in the dimensions of machined parts.

A test is described which is useful in the evaluation of aluminum cleaners. Aluminum strips $\frac{1}{4}$ in. wide by 1 to 2 in. long are inserted in 6-in. calibrated test tubes which have been filled with the cleaner solution and inverted in the beaker containing the solution. For exact quantitative determination the metal strip is cleaned with benzene or ether, wiped and weighed. The strips are inserted in the test tubes and the beakers placed in a water or steam bath at 200 F. for a given period (15 min.). At the end of this period, the gas evolved is measured, the pieces removed, and rinsed in a standard manner and weighed.

A specification for a suitable material would read: Solution concentration of 2 to 6 per cent by weight should not evolve more than 2 cc. of gas nor dissolve more than one milligram of metal per square inch of surface at 200 to 210 F. The material should rinse freely and leave no visible deposit.

In aluminum cleaning, solutions should be maintained at not over 210 F. and preferably at 200 F.

This method may be applied to zinc and its alloys, such as die-casting metal, or magnesium alloys.

(33) R. W. Mitchell, "The Cleaning of Metal," *Metal Cleaning and Finishing*, Vol. 2, pp. 13–18, 111–114, 207–210, 299–304, 389–395, 485–493, 585–594, 598, 673–680, 684, 759–762, 839–847, 935–945, 1025–1031 (1930).

Theoretical and practical discussion of the action of cleaning compounds; general explanation of alkalinity ranges and the colloidal and buffer actions of cleaners. Colloidal action as applied to detergent processes. Properties of soap and other washing colloids. Surface tensions of various liquid solutions and colloidal solutions and their relation to detergent action. Interfacial tension. Adsorption and emulsification. Alkalinity and acidity. Buffer action. Measurement of cleaning action. Comparison of various detergents.

(34) E. G. Porst, "Metal Cleaning," *American Enameler*, Vol. 3, No. 6, p. 9, No. 7, p. 5 (1930); *Journal*, Inst. Metals, Vol. 50, p. 578 (1930).

The type of cleaner is determined by the kind of soil to be removed. Soil removal is divided into two steps: (1) wetting, (2) suspending. The actual dislodging is accomplished in one or more ways: (1) saponification, (2) dissolution, (3) chemical dissolution, (4) agitation, (5) colloidal action, and (6) heating.

(35) H. S. Rawdon, "Corrosion-Prevention Methods as Applied in Aircraft Construction," *Proceedings*, Am. Soc. Testing Mats., Vol. 30, Part II, p. 61 (1930); *Chemical Abstracts*, Vol. 25, p. 1786 (1931).

Bare aluminum surfaces are cleaned by the use of a mild etching solution such as a dilute solution of phosphoric acid. Another solution is a caustic "dip" followed by neutralization with weak acid. Mild abrasives may be used, even sandblasting for the heavier parts, each followed by chemical cleaning. Special precautions are to be taken against "crevice" corrosion involving the use of protective tape, etc.

(36) Frank P. Spruance, "Initial Cleaning and Preparation of Sheet Metal Surfaces of Bodies Are of Major Importance in Production," *Automotive Industry*, Vol. 62, pp. 374–376 (1930); *Journal*, Inst. Metals, Vol. 47, p. 680 (1931).

Metal cleaners should: (1) remove oil, grease and antisqueak compounds so that the entire surface can be acted upon, (2) remove rust and destroy rust removers, (3) remove alkalies and destroy their paint shedding action, and (4) produce a surface to which the prime coat will adhere tightly.

(37) Hermann Stadlinger, "Newer Methods for Cleaning Oily Metal Parts in Industrial and Technical Processes," *Chemiker-Zeitung*, Vol. 54, pp. 354–355 (1930); *Journal*, Inst. Metals, Vol. 47, p. 457 (1931); *Chemical Abstracts*, Vol. 24, p. 3578 (1930).

Various methods are described. A new cleaner, "P 3" sold in powder form by Henkel and Co. consists of a mixture of low alkali water glass and trisodium phosphate. Experiments show no corrosion of aluminum, zinc, etc. Also a special grade which does not attack tin plate, brass or duralumin is produced. In special metal washing machines 1 to 4 per cent solutions at 80 to 90 C. will serve, depending upon the kind of oil and dirt.

(38) James G. Vail, "Sodium Metasilicate: Its Place Among Industrial Alkalies," *Chemical and Metallurgical Engineering*, Vol. 37, pp. 736–740 (1930); *Transactions*, Am. Inst. Chemical Engrs., Vol. 25, p. 123–142 (1930); *Chemical Abstracts*, Vol. 25, p. 777 (1931).

Greasy aluminum jar caps were cleaned with 1 per cent boiling solutions of commercial alkalies for 5 min. The metasilicate produces a bright surface while corrosion was apparent with the others. Similar results were obtained even when solutions had the same Na_2O content. Corrosive action upon aluminum is said to be due at least in part to the anion involved.

(39) Tom L. Wheeler, Jr., "Industrial Cleaning," *Brass World*, Vol. 26, pp. 11–14 (1930); *Journal*, Inst. Metals, Vol. 43, p. 672 (1930).

General discussion.

(40) " 'Metso'—a New Cleaner for Aluminum," *Aluminum Broadcast*, Vol. 3, No. 6, p. 20 (1931); *Journal*, Inst. Metals, Vol. 50, p. 706 (1932).

This is a proprietary form of sodium metasilicate. A 1 per cent solution in certain cases is said to clean aluminum without corrosion.

(41) "New Process of Metal Cleaning (Emulso Primer)," *Metal Cleaning and Finishing*, Vol. 3, p. 921 (1931); *Journal*, Inst. Metals, Vol. 50, p. 707 (1932).

The Emulso primers are triethanolamine salts, useful for emulsion cleaning of aluminum.

(42) "Bullard-Dunn Electrochemical Cleaning Process," *Maschinenkonstrukteur*, Vol. 64, p. 111 (1931); *Journal*, Inst. Metals, Vol. 50, p. 768 (1932).

Descaling with hydrogen and the deposition of lead which affords protection for the metal against etching, pitting or hydrogen embrittlement. The process can be modified to remove oil or grease. It is claimed that no alteration of measurement takes place at the same time facilitating the determination of flaws. The lead coating may be used as an undercoat for subsequent plating.

(43) "Clean Metal Surfaces," *Oberflächentechnik*, Vol. 8, pp. 2–5 (1931); *Journal*, Inst. Metals, Vol. 50, p. 263 (1932).

Methods are described for cleaning and polishing of ferrous and nonferrous metal castings.

(44) A. Burg, "Degreasing and Cleaning Metal Parts," *Emailltechnik Monats Blätter*, Vol. 7, pp. 51–54 (1931); *Journal*, Inst. Metals, Vol. 50, p. 192 (1932).

In the preparation of metal pieces for enameling it is necessary to thoroughly degrease and clean the surface. The annealing process is used to burn off oil and grease or the surface is cleaned chemically by treating in baths of organic or inorganic solvents. The latter are divided into three classes: (1) solvents, (2) emulsifying agents, and (3) saponifying chemicals.

(45) E. J. Dobbs, "Theory of Metal Cleaning," *Journal*, Electrodepositors Tech. Soc., Vol. 7, pp. 161–162 (1931–1932); *Journal*, Inst. Metals, Vol. 53, p. 216 (1933).

Wetting power, emulsifying and peptizing action are shown to be necessary functions of complex aqueous metal cleaning solutions. The constituents of the metal cleaner contributing each are discussed. The use of organic solvents especially in the vapor phase is reviewed. An etching process is described for cleaning steel and brass prior to electrodeposition.

(46) C. L. Mantell, "Composition and Uses of Heavy-Duty Metal Cleaners," *Metal Cleaning and Finishing*, Vol. 3, pp. 305–306 (1931); *Journal*, Inst. Metals, Vol. 50, p. 707 (1932).

An explanation is given for buffer action in cleaning operations.

(47) C. L. Mantell, "Alkali Solutions as Metal Cleaners," *Metal Cleaning and Finishing*, Vol. 3, pp. 641–645 (1931); *Journal*, Inst. Metals, Vol. 50, p. 505 (1932); *Chemical Abstracts*, Vol. 25, p. 5653 (1931).

Relation between pH, ionization, concentration and temperature of alkaline solutions containing $NaOH$, sodium carbonate, ammonia and their combinations is outlined. It is shown that such solutions have definite limitations for cleaning purposes, their saponifying action being less important than supposed.

(48) C. L. Mantell, "Testing of Electrocleaners," *Metal Cleaning and Finishing*, Vol. 3, pp. 945–949 (1931).

An outline of methods for the determination of conductivity of cleaning solutions of various compositions.

(49) R. W. Mitchell, "Equipment for Cleaning Metal," *Metal Cleaning and Finishing*, Vol. 3, pp. 13–26, 107–115, 195–203, 287–294, 377–382, 463–466, 549–552, 631–634, 711–714, 793–796, 869–874, 953–957 (1931); Vol. 4, pp. 15–19, 71–78, 139–146, 207–214, 273–276, 333–338, 389–394, 445–450, 491–495, 541–545, 589–592, 637–642 (1931); Vol. 5, pp. 31–35 (1933).

Mainly a discussion of equipment. Other factors discussed are temperature in relation to cleaning operations, agitation as an aid to cleansing, importance of rinsing, theory and methods employed in electrolytic cleaning.

(50) R. W. Mitchell, "Maintenance and Life of Cleaning Solutions," *Monthly Review*, Am. Electroplaters' Soc., Vol. 18, No. 6, pp. 30–34 (1931); *Journal*, Inst. Metals, Vol. 50, p. 121 (1932).

A method is given for replenishing cleaning solutions.

(51) Floyd T. Taylor, "Bullard-Dunn Process of Cleaning," *Monthly Review*, Am. Electroplaters' Soc., Vol. 18, No. 8, pp. 17–22 (1931); *Journal*, Inst. Metals, Vol. 50, p. 121 (1932).

The process comprises electrolytic cleaning in sulfate-chloride electrolyte using lead anodes, whereby scale is removed and replaced with a lead film to prevent subsequent oxidation. The article so cleaned may be plated without removal of the lead film, or the film may be removed by a short anodic treatment in an alkaline bath.

(52) A. D. Weill, "Modern Practice in Metal Cleaning," *Journal*, Electrodepositors' Tech. Soc., Vol. 7, pp. 157–160 (1931–1932); *Journal*, Inst. Metals, Vol. 53, p. 216 (1933).

Aluminum cleaning is accomplished with aqueous solutions composed of mild alkalies such as phosphates and/or cyanides. Electrolytic cathodic cleaners may contain copper salts; incomplete deposition of the copper film indicating greasy patches. Suitable methods are given for cleaning stampings of brass, and similar metals, diecastings of zinc, aluminum and tin alloys, lead and pewter prior to electroplating.

(53) S. Wernick, "The Cleaning of Iron and Steel," *Journal*, Electrodepositors' Tech. Soc., Vol. 7, pp. 163–165 (1931–1932); *Journal*, Inst. Metals, Vol. 53, p. 216 (1933).

Methods for descaling, degreasing and electrocleaning steel prior to electroplating or other finishing is described. Discussion of the function of soap deliberately added or formed by saponification, together with rinsing properties, method providing visual evidence of completeness of grease removal, and the use of inhibitors in acid solutions to prevent overpickling.

(54) Leslie Wright and F. Taylor, "Modern Metal Cleaning," *Journal*, Electroplaters and Depositors Tech. Soc., Vol. 6, pp. 71–90 (1931); *Journal*, Inst. Metals, Vol. 47, p. 406 (1931).

Includes an historical introduction from the time of Berzelius to the present. The constitution of soap solutions and their physical properties are enumerated, and the mechanism of cleaning with special reference to the action of alkalies is discussed. Measurable values in the evaluation of alkalies are: (1) actual alkalinity (pH), (2) potential alkalinity denoting reserve, and (3) buffer value. Detergent actions described. Methods for measuring detergent action are outlined and the materials involved are discussed. Alkalies, together with soap constitute the best detergent, and factors determining the type of soap used in metal cleaning are cost, foaming, free rinsing, and solubility. Rosin soap (as against tallow) is highly satisfactory because of free rinsing. High pH causes tarnishing but this is minimized by the addition of inhibitors such as sodium silicate.

(55) "Cleaning Aluminum Tanks," *The Metal Industry* (New York), April, 1932, p. 146; August, 1932, p. 330. *Aluminium Broadcast*, Vol. 3, December 1, 1932, p. 17.

Difficulty in the proper pickling of aluminum tanks is outlined. Shows the need for control of the pickling bath and the subsequent rinse.

(56) "Aluminum Cleaner," *The Metal Industry* (New York), Vol. 30, June, 1932, p. 249.

The proprietary product "Houghto-Clean" for aluminum cleaning is described. Said to be designed for each special type of application.

(57) "Cleaning Aluminum," *American Machinist*, European Edition, Vol. 76, p. 973 (1932); *Journal*, Inst. Metals, Vol. 53, p. 52 (1933).

Types of solutions most suitable for aluminum cleaning are: (1) volatile solvents, (2) aqueous solutions of soap and mild alkalies, and (3) "water soluble controlled alkali" solutions. The make-up and method of using these solutions is described. A matt finish is produced by dipping the work in a solution containing 5 gal. nitric acid, 1 gal. hydrofluoric acid, 1 qt. sulfuric acid, or eight parts nitric acid and one part hydrofluoric acid.

(58) "Cleaning Metal Parts," *Industrial Finishing*, Vol. 10, No. 1, November, 1933, p. 9.

A description of wet cleaning of metals with naphtha or chemical solutions applied by hand dipping or by automatic dipping or spraying as the material is mechanically conveyed to and from the cleaning, rinsing and drying stations.

(59) "Cleaning Products for Brewing Vats," *Aluminum Limited Abstract Bulletin 4*, March 15, 1933, p. 15.

A study of the action, on aluminum, of special products intended to retard corrosion, which are added to the cleaning products used to dissolve the tartar of brewery vats and vessels. A number of proprietary German products are listed. Very satisfactory results were obtained with sulfonated acids.

(60) L. E. Frost, "Paint Metal Products," *Industrial Finishing*, Vol. 10, No. 1, November, 1933, p. 19.

Methods are given for the removal of grease and dirt with petroleum products such as benzene or gasoline; with lacquer thinner or toluol; or with a cleaning compound dissolved in water, all preparatory to painting.

(61) J. Geschelin, "Metal Cleaning, Methods and Materials," *Automotive Industry*, Vol. 68, pp. 466–470, 522–526, 702–703 (1933); *Journal*, Inst. Metals, Vol. 53, p. 584 (1933).

Aluminum is best cleaned by the use of a mild alkaline cleaner or solvent, then rinsed in clear, cold water. The surface is then made uniformly active by dipping for from 5 to 30 sec. in a solution of one part 50 per cent HF with nine parts water. In the case where an acid dip is to follow, the preliminary dip is eliminated. The surface is then roughened by etching, rinsed in clear cold water and then transferred to the plating bath. Care must be taken in the selection of the alkaline cleaner, and it is recommended that equal quantities of sodium carbonate and trisodium phosphate be added in 1 to 3 oz. quantities to 1 gal. of water at 180 to 200 F. Such a mixture attacks the metal mildly in the same manner as an electrolytic cleaning.

Quotes the New Jersey Zinc Co. recommendations for zinc cleaning.

(62) "A Select, Annotated Bibliography on the Hygienic Aspects of Aluminum and Aluminum Utensils," *Bulletin No. 3*, Mellon Inst. of Industrial Research, 69 pp., 150 references (1933).

(63) E. B. Sanigar, "Specifications for Chemicals and in Cleaning Metals," *Monthly Review*, Am. Electroplaters' Soc., Vol. 20, No. 3, pp. 26–29 (1933); *Journal*, Inst. Metals, Vol. 1, p. 207 (1934).

Chemical specifications are given for sodium hydroxide, sodium carbonate, sodium silicate, trisodium phosphate, potassium hydroxide, potassium carbonate, trichlorethylene, and carbontetrachloride.

[*NOTE—The remainder of this Bibliography, references 64 to 127, will appear in the March ASTM BULLETIN.*]

Philadelphia District Meeting on Theory and Use of Specifications

Army and Navy Personnel, Industry Representatives Speak

Some 200 members of the Society including a large group who were attending the Philadelphia meetings of Committee A-1 on Steel, and other engineers and technical students in the Philadelphia area attended the meeting at the Hotel Warwick on Wednesday, January 20, sponsored by the Philadelphia District Committee on the subject "The Theory and Use of Specifications." The District Committee was honored by having as guest speakers Commander E. C. Forsyth, Officer in Charge, Standards and Tests Section, Bureau of Ships, Navy Department, and chairman, Navy Dept. Specification Board, and E. L. Hollady, Technical Advisor, Specification Unit, Materials Section, Service Branch, Technical Division, Office of Chief of Ordnance, Washington; and other Society members participated in the meeting on short notice. N. L. Mochel, Manager, Metallurgical Engineering, Westinghouse Electric and Manufacturing Co., who had originally been scheduled to speak, was called to the West Coast on an important emergency matter. Invited speakers included: L. B. Jones, Engineer of Tests, Test Department, The Pennsylvania Railroad Co.; A. O. Schaefer, Engineer of Tests and Inspection, The Midvale Co.; L. H. Winkler, Metallurgical Engineer, Bethlehem Steel Co., Inc.; and R. W. Orr, Standardizing Division, RCA Manufacturing Co., Inc. F. G. Tatnall, Baldwin-Southwark Corp., chairman of the Philadelphia District Committee, presided and saw to it that interest in the discussion did not flag. Following the technical session there was a showing of the interesting color-sound film "Combat" (Man against Insects) presented through the courtesy of the General Chemical Co.

Some of the speakers had prepared remarks or notes and others spoke extemporaneously.

Commander Forsyth on Specifications

I am indeed pleased to be present at this meeting and to participate in this discussion, but I regret that Mr. Mochel will not be here to speak on the general topic of "The Theory and Use of Specifications" as I am sure that his presentation of that topic would be most interesting and helpful.

But perhaps, after all, it may not be too hard for us to guess at some of the things that Mr. Mochel might have presented. For one thing, I note that he was to speak on the use of specifications. Briefly, I consider that the primary use of a specification is to convey from the purchaser, or user, to the manufacturer sufficient information as to what is required so as to enable the manufacturer to produce material or equipment which will be suitable for the use intended. At the same time, that specification should provide for inspection adequate to insure the user that the material or equipment, once manufactured and delivered, can be used without further consideration as to its adequacy. In this, the task of both the maker and the user appears to me to be fairly definitely defined, and along these lines I desire to point out our approach as a user to the task which is before us. I also desire to indicate how this approach has been developed in the past as a matter of practice, and how it has been fitted into present conditions.

Our purpose is to define what we want, and primarily our approach to this job has been and, in so far as practicable, will continue to be on the basis of required performance. In this it is our endeavor to inform the manufacturers of what we need and what the article or material is to do rather than to try to tell them how to make something. In this way many minds are constantly attacking our problems, all with the same objectives and each from his own point of view.

From this method of procedure I consider that both ourselves and the manufacturers benefit. The manufacturer retains his initiative in the development of his own engineering and manufacturing skill and facilities, and is able constantly to consider improvement of his product as well as of his methods of production. On our part, we get the benefit of all of this and at the same time our sources of procurement are broadened and increased, and our specifications remain functional, flexible, and standardized. It is necessary that we do this from the point of view of the use of our specifications, for they are the fundamental beginnings of the design and construction of our ships. They are, if you will, the bricks with which we build our house and it is necessary that those bricks have certain fixed characteristics in order that the house may, when fully built, end up by being what we prescribed when we started. Thus we have truly made a virtue of a necessity. The necessity is there and acknowledged, but the virtue cannot be escaped.

Occasionally it is necessary to prescribe or specify by definition of a fixed design or method of manufacture, but in my opinion this should be avoided as far as it is possible to do so for if we standardize in general on a fixed design we have frozen our objective, we have immobilized our engineering skill and ability, and we have slowed down or stopped progress. We have also excluded from our procurement field those materials or equipments which do not rigidly follow this fixed design.

The Navy Department has long recognized, and indeed lent every emphasis, to the importance of specifications and of the necessity for a uniform method of preparation and expression of requirements in order that the full objectives of its procurement in time of war could be realized. It is largely because this was so long ago realized and thoroughly worked out, both in administrative organization and in technical detail, that procurement for and by the Navy has been fairly successful despite many other, and in most cases more obvious, troubles.

At the risk of repetition, but because of certain obviously inaccurate and incorrect statements which have appeared in recent times, I desire to point out that the evidence exists in facts fully to substantiate that the Navy has for a

very long time indeed been among the leaders in the country in the preparation of specifications and their standardization and simplification. Going back, if you will, to May, 1868, there was issued by the Navy Department the Standard Gage for Bolts, Nuts, and Screw Threads, which was, I believe, the first standard for this material in the country. In more recent times, I refer to our specifications for electrical measuring instruments, initiated about 1915, revised on the basis of performance in 1925, and in 1930 presented to the International Electro-Technical Commission and offered as a contribution of the U. S. National Committee for world standardization. Coming to even more recent time, we have our Radiographic Standards, which in their short period of use of about three years have gone far toward standardization and simplification of correct steel casting technique. These are but a few examples and are only quoted to illustrate the one point that Navy specification practice has been established and working for many years. This has been the establishment and background of our practice and now I may call attention briefly to some of the details.

First, standardization. Like many other words in the English language this word is capable of definition and interpretation almost at will to suit the purpose of the moment. In so far as specifications are concerned, the term may be perhaps defined or applied in two ways. We may, as I have said, standardize upon a fixed design or method of manufacture but this I do not believe is the most desirable. Rather we have and will continue to standardize as far as possible on required performance. This is essential to progress; it is essential to procurement, especially under present conditions; and it is essential to the designer and builder of Naval vessels.

Now this word performance covers a wide field. It includes interchangeability and the provision for replacement. It includes factors of physical strength and endurance, corrosion resistance, resistance to flammability and a multitude of functional requirements, each and every one of which must be given full and careful consideration in the preparation of every specification. It is our aim in the preparation of such specifications to define as fully and completely as possible minimum acceptable performance requirements; the least that will do the job, not the most or the best. In this, every phase not only in the construction of Naval vessels and their operation but also in the manufacture of materials which enters into the design and operation of those ships must be examined and considered. This is a tremendous task and one which has no beginning and no ending.

There are many well intentioned persons who would help us in this task, and that is good. All the technical brains and ability in the country should be concentrated on the task of successfully concluding the war at the earliest possible date. But like everything else where the purpose is so large and so comprehensive in nature, it can be recognized that the efforts of all must be directed in the proper channels or else they cross and recross in all directions and end up nowhere. The building and operating of a fleet is a tremendous job in its technical detail, yet fundamentally every one of those details must revert to the requirements for operating Naval vessels under conditions of combat and for those requirements we must invariably go back to the experience of the operating personnel. A vast store of this information is accumulated in the Navy Department. In fact it is the only place in which such information is available. Starting with this, we examine every item that enters into Naval vessels to determine its part in that performance. Then, that individual performance requirement is written into a specification for the procurement of such parts as may be necessary. It is, however, at the same time equally necessary in the preparation of specifications to examine and to know the source of supply in order that we may determine that what we want and prescribe is in fact available and can be made. This is an equally important function of the specification writer and it is to this end that for many years we have been examining by contact and conference with manufacturers and examination of their products, and by a comprehensive test program of such products both in laboratories and afloat, all materials and equipment which offer anything reasonable in the way of suitability and performance for use in Naval vessels. Here, too, we have accumulated a large store of information, not just with regard to the intrinsic merit of the various products but rather with regard to what their specific merit is in connection with our needs and applications.

These two basic requirements must be carried forward side by side in the preparation of every specification, and thus we come to the third requirement which is inspection to demonstrate that the material or equipment which we have prescribed and made will without further consideration on the part of the user be suitable for the purpose for which it was made. Here the performance requirement is paramount and here it is finally demonstrated, for without it, as truly as the kingdom was lost for want of a horseshoe nail, so may the ship be lost by failure or inadequacy of its parts.

In your letter of invitation to speak at this meeting, mention was made of the utility of specifications. Properly prepared specifications in which the factors that I have spoken of have been fully considered and successfully included, I believe most highly serve in the war production program as they point out and permit and encourage every qualified manufacturer to produce what he is best prepared to produce to fit the needs of the military services in the conduct of the war. Such specifications permit each and every manufacturer to see his own product in the light of the application requirements and for himself to judge that he has done well. It must be emphasized that from such a viewpoint specifications are written in order to procure something for which a definite need has been established. They are not written to dispose of something which is already made. A good specification is one so written as to permit the utilization of all material which may be suitable for a clearly defined purpose. It is to this end in the preparation of specifications that our ultimate objective is a clear description of performance requirements.

E. L. Hollady Comments

Mr. Hollady, who was in attendance at a number of the Steel Committee meetings, spoke from notes and his remarks included the following:

What do we think of standard specifications, and are they doing the job for which they are intended?

To answer briefly: American industry could not have attained its high position in peacetime production with

regard to quality and quantity, without standard specifications maintained by competent organizations such as A.S.T.M. and other standardizing agencies. Industry could not have met the demands of the war production program without definite standard specifications, both Government and commercial, and the support of the same organization.

What is the job which specifications must do?

Primarily, they must serve as a basis for agreement between producer and user.

In a huge organization, such as a Government department, specifications must serve a number of purposes because they are written by one group, applied in design by other groups, and used in procurement, production, and inspection by thousands of individuals who have little or no direct contact with either the specification writer or the designer. The principal purposes of such specifications are:

1. To guide engineers and designers in selecting suitable materials;
2. To promote standardization and simplification within the organization or department;
3. To provide a basis for planning for the supply of raw materials;
4. To effect the conservation and proper use of critical materials;
5. To serve as contract document;
6. To provide brief but definite instructions to inspectors.

The whole picture is further complicated by the necessity for applying the specifications together in various combinations without duplications and contradictions.

Specifications are doing this job because they are based on the firm foundation developed and maintained by American industry through such standardizing agencies as A.S.T.M.

Are there any kinks in our specifications? Yes, in individual specifications. Not in the system as a whole. Individual specifications can be and are being revised or modified to remove the kinks and to meet the changing conditions of wartime.

Other Comments

H. H. Morgan, Chief Engineer, Robert W. Hunt Co., commenting from the floor, said that specifications might be considered to fall in three broad classifications: the project specification such as for a battle fleet, for example; a product specification which would be components of the project; and the materials specifications which in turn would be fabricated into the product. He mentioned the great activity of A.S.T.M. in this materials phase, stressing the importance of having adequate materials specifications.

Mr. Jones, as requested, discussed some of the important standardization and simplification work in the railroad field outlining some of the activities of the Association of American Railroads technical groups, such as the A.A.R. Mechanical Division and the Engineering Division (former A.R.E.A.) and cited numerous emergency specifications developed by these groups, outlining some of the steps taken to help increase production.

Mr. Winkler also paid tribute to the work of standardizing bodies, in particular A.S.T.M., stating his personal conviction that the work in so far as possible should be correlated among groups which specialize in this type of activity.

Mr. Schaefer offered the following comments:

"Specifications always remind me of a professor of English at the Military Academy at West Point about whom Colonel Fletcher used to tell us when he was in this district. He stated that it was just as important *not* to say what you did *not* want to say as it was *to say* what you wanted *to say*. I think that thought applies to specifications. Mr. Hollady spoke of the necessity of including contractual material and other information in certain Government specifications. I think that is most unfortunate. In the organization where I am employed it is our practice to rewrite customers' specifications and issue them as manufacturing specifications to our works. It has been our experience that if these specifications exceed a certain length they are either not read or parts of them are overlooked. It seems important to me, therefore, in specification writing to boil the substance down to an absolute minimum. The policy followed by A.S.T.M. and also by Army and Navy specifications of removing descriptions of the tests to separate documents which can be referred to in the material specifications is a very good practice and it has helped considerably in clarifying specifications and in making them shorter. Tonight we have heard certain definitions of specifications. While this is not a definition, I always think of a specification and the blueprint that goes with it as being the materials with which the purchaser's engineers state their needs to the manufacturer's engineers. Looked at in this light it is even more important that the specification be free from contractual matter that is of interest principally to purchasing agents.

R. W. Orr made the following remarks:

I should like to emphasize three points which have already been discussed. These are often overlooked in preparing specifications, particularly where emergency standards are needed in industries that have not done much previously in the way of standardization.

1. Particular care should be paid to the significance of tests required.
2. Specifications should cover performance in so far as possible, rather than manufacture, ingredients, etc.
3. Avoid tendency to overspecify. Don't specify too many properties or too close limits. In other words, keep free of what has sometimes been called "designer's itch."

If one were to attempt a summary of the meeting, it might be this: Materials Specifications, which are essentially a statement of what the consumer wants the producer to furnish him, are serving a very important need; have contributed immeasurably to our production and war effort and while some of them do have "kinks" and changes are constantly necessary, in general, those specifications which have received careful consideration of those concerned are doing the job intended, also, the ultimate objective in the preparation of specifications is a performance standard.

Material specifications are, in the main, simply definitions of the properties of the materials which the purchaser desires. They represent his best efforts to state in measurable terms those properties which are necessary for satisfactory use at the least cost consistent with the desired quality. In addition, they include methods of test and disposition of material in case of failure to meet requirements and serve to provide a basis of inspection mutually agreed upon between the supplier and the purchaser—*J. W. Bancker, Western Electric Co.*

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Another Book of Standards

At long last, after weeks and months of effort, the 1942 Book of A.S.T.M. Standards is a reality. During the publication period which has extended over many weeks numerous problems have had to be solved, there have been the usual number of publishing headaches, and undoubtedly considerable "cussing" both by the printer and the Headquarters Staff, but throughout, the spirit of cooperation has been excellent, and in spite of some unavoidable obstacles, the books are issued reasonably close to the time schedule.

Probably the most tangible evidence of the work of the Society in the field of standardizing specifications and testing, these books really speak for themselves.

May we be excused, however, for a few words and thoughts.

The book is distributed throughout the world (this year of course excepting the Axis nations and certain other countries where censorship rules have barred it). The demand from some of our Allies is so great that with shipping restrictions it will be some months before we can fill all the demands. The book goes to the textile mills in India, steel mills in Russia, railroads in South Africa, the timber companies in Australia, etc.

Why is it so widely distributed and used? Essentially because it represents the considered opinion of leading consumers and producers of the wide range of materials covered, in which the producer is agreed that he can furnish to the consumer a commodity with certain properties and under certain consumer qualifications. In speaking at the recent Philadelphia meeting, E. L. Hollady stated that a specification embodied the accumulated experience of many engineers and technologists, users and producers, invaluable experience that was set down in a few printed pages. So, the Book of A.S.T.M. Standards. The specifications and tests represent the results of meetings, thousands of letters, and the cooperative efforts of thousands of leading American, Canadian, and other technical men and engineers who are cognizant of the tremendous importance, particularly in a time of national emergency, of quality standards.

The 1942 Book of A.S.T.M. Standards, in three Parts, is not a perfect volume, nor are any of the 1070 standards perfect (or the additional 22 in the volume on Chemical Analysis of Metals), but representing as it does the considered opinion and agreement of such a vast assemblage of engineering talent and experience it seems appropriate to term the book the "voice of authority" in the field of engineering materials.

Ten A.S.T.M. Districts

This issue of the Bulletin includes a recording of statements and comments made at the Philadelphia District meeting on the subject "Theory and Use of Specifications" and also announces the formation of the newest A.S.T.M. District Committee—the Western New York-Ontario District group. The importance to the Society of our ten District Committees has been mentioned on previous occasions and the numerous ways in which they have helped the Society have ranged from membership promotional work to the arranging of annual meeting features. From the nature of our setup as a national technical Society, so-called local sections are probably not desirable—certainly not essential—but it is desirable that in leading industrial centers we have groups of members who can act as a focal point for various A.S.T.M. activities.

Far from the least of the contributions from District Committees are the discussions and papers and reports presented at local meetings, such as the discussions at the Philadelphia meeting. It is salutary to consider, as was done at this meeting, some of the inherent strength or weakness of the standardization movement as exemplified by A.S.T.M. work. It is heartening to hear from representatives of industry and Government that specifications by and large are really doing a job.

A number of valuable A.S.T.M. technical publications have resulted from meetings sponsored by District Committees. While there has been no commitment with respect to publishing the papers to be presented in the Symposium on Powder Metallurgy and the Symposium on Paint, features of the 1943 Spring Meeting in Buffalo, nevertheless, the holding of these symposiums by the new Buffalo District Committee will result in dissemination of valuable information.

It is expected District Committee activities will increase gradually in importance.

Comments on "the Engineer"

As a national *technical* Society, the Society is not necessarily always concerned with some of the *professional* problems which must be and are being handled by many of the *engineering* societies. Nevertheless, with a very high percentage of our members listed as engineers, most being technical men, and the engineering and technical approach being essential in A.S.T.M. work we are, of course, concerned with "the engineer," as such. Recently the American Society of Civil Engineers published some interesting comments on the engineer, one by C. R. Young, President of the Engineering Institute of Canada on "The Place of the Engineer." His closing paragraphs are worthy of scrutiny.

"The plain truth is that the solution of many of our problems does not lie where engineers think it does. L. G. Straub has effectively pointed

out the futility of the one-track approach. He believes that the engineer 'fails to recognize that the structure of our social-economic order is dynamic and constantly changing—fundamentally different from technology.'

"And so the place of the engineer in the future is largely conditional upon the breadth of his outlook, his interests and his activities. For one who buttresses his technical competency with a wholesome regard for the interests of his fellows and with constructive labors on their behalf, it is secure. That security is not augmented by a straining after status. More than anything else, it rests upon the individual stature of the engineer himself."

In another issue of *Civil Engineering* there are some comments by D. B. Steinman who has done much to keep the value of the engineer in the public eye. After indicating that the engineer is the protagonist of efficiency and the great coordinator, he points out that the engineer investigates with open mind and gets facts before he makes a decision. This reminds us of the statement of the former General J. J. Carty, Bell Telephone system that "if 95 per cent of the facts that bear on a situation are known, the solution to a problem is almost self evident."

This brings us to a note in the "Cleveland Engineering Society News" reading:

"But a nation's chief resources
Are those contained in hats."

It is indicated that technical and scientific men often so much in the background because of their shyness and aversion to publicity nevertheless have been and always will be the foundation of every advance of civilization.

Most of us would be in complete agreement with the foregoing expressions. We might ask a question, however. Is it possible that the engineer's present position which is admittedly one of tremendous influence comes about for one reason because he gets things done; and not because of a profundity, or lack of, articulation?

Pathos and Heart Interest in Technical Writing

Some of the communications received at A.S.T.M. Headquarters written in good faith really are humorous when viewed in the light of an understanding of what Society problems are. Such, for example, the very beautifully and elaborately phrased letter from a New York gentleman who renders "superlative service in preparing manuscripts for the printer." He asked that we submit a manuscript to him for editing and he "would consider timeliness of theme, good characterization, proper motivation, inspiration, pathos, heart interest, uncensorious humor, suspense and surprise. Also he apparently considers the "dramatic values of living humanity." The question has been raised concerning the dramatic values of the departed but that may be an involved discussion.

It is quite possible that some of the officers of standing committees would like to determine whether their standards have any heart interests—admittedly there is considerable pathos, indubitably much suspense, and frequently to those who may have been somewhat asleep a measure of surprise. This gentleman also takes care of seeing that sequences are right. Perhaps the chief aim of our technical people is to see that *con*sequences are right.

Publication Dates

Book of A.S.T.M. Standards, Part II, Nonmetallic Materials, Constructional; and Part III, Nonmetallic Materials, General, distribution practically complete; Part I, Metals, distribution to begin February 10.

Index to A.S.T.M. Standards including Tentative Standards, distribution about February 20.

Volume on Methods of Chemical Analysis of Metals, distribution about April 1.

Symposium on Radiography, distribution about March 30

Special Compilations of Standards on:

Electrical Insulating Materials (D-9)	February 20
Rubber Products (D-11)	March 1
Copper and Copper Alloys (B-5)	March 1
Refractory Materials (C-8)	April 1

1942 Proceedings, distribution in March.

Last Call for Annual Meeting Papers

Detailed consideration will be given to the program for the 1943 Annual Meeting to be held in Pittsburgh, Pa., June 28–July 1, 1943, by Committee E-6 on Papers and Publications at its meeting to be held on February 22. At this time offers of papers for presentation at the annual meeting will be studied from the standpoint of importance, nature of the particular problem involved, and also its relation to other topics on the program.

The Pittsburgh meeting will concentrate on subjects that have a direct bearing on the war effort. While naturally a number of investigations that are now under way are such that the results will need to be kept secret for the time being, nevertheless, there is much work in progress that would contribute very definitely to the war effort if the results were made available to industry through the presentation of technical papers and wherever this can be done without divulging secret information it is urged that offers of papers be submitted to the Papers Committee. Offer forms should be received at A.S.T.M. Headquarters by February 18.

Expansion of A.S.T.M. Headquarters

Relatively little has appeared in the Bulletin about the physical features of the Society's Offices. A recent expansion, however, prompts the following as of possible interest.

The Society in 1933 moved its offices from the Engineers' Club at 1317 Spruce Street where they had been located from 1919, when the shift was made from the Civil Engineering Department of the University of Pennsylvania. The amount of space acquired at 260 S. Broad St. totaled 2625 sq. ft., which with storage space of 425 sq. ft. gave a total of 3050. Additions became desirable about five years later and both office and storage space was increased. Additional storage space was added in 1942 and as of January 1, 1943, the Society has rented on a year-to-year lease two additional rooms on the Fifth Floor of the Atlantic Building, 260 S. Broad St., which will bring the total office space to 3865 sq. ft., storage space to about

1165, totaling just over 5030 sq. ft., roughly a 70 per cent increase over that first leased in 1933. The highest percentage of increase has been in storage space, required by tremendous increase in the number of standards and tentative standards which must be kept in separate form in some quantity, and also the Books of Standards and other bound publications which are stored in reasonable quantities for prompt shipment.

Meanwhile, the staff has grown from 14 in 1933 to the present number of 27. This expansion has included more editorial assistants, additional stenographic and clerical help, and an assistant shipping clerk.

The expanded offices continue to include a Members' Lounge and the Board Room which is used by the Executive Committee for its meetings and which during the past year has been extensively used by Society committees and, in particular, by subcommittees of the National Emergency Steel Specifications Groups.

As members know, 260 S. Broad St. is just a short half block from the Engineers' Club and there are a number of restaurants and hotels literally within a stone's throw. Both the Pennsylvania Suburban Station and the Reading Terminal can be reached in a short walk (underground *via* the concourse when inclement weather is experienced) and the Baltimore and Ohio and the Pennsylvania Thirtieth Street Station are a short taxi ride.

Members are at all times cordially welcome to use the Headquarters as an appointment place and the Staff would be glad to welcome any members who have a few minutes to spare while in Philadelphia and would care to pay us a short visit.

Several New Sustaining Members

13 Additional Organizations Added to List, Total Now 160

EFFECTIVE AS of January 1, 1943, 13 organizations, with one exception all affiliated with the Society a number of years, have become sustaining members of the Society; one company, the United Aircraft Corporation, began its sustaining membership during the latter half of 1942. These organizations and many of their technical men have been extremely active in various phases of the work of the Society. This list of latest additions to the sustaining membership group affords an excellent cross-section of the Society members. With these new members the total number of organizations in the sustaining membership class is now 160.

It has been indicated on previous occasions that sustaining members contribute annual dues of $100. There are certain distinct advantages of this class of membership, in particular the receipt of a copy of *every* A.S.T.M. publication issued, a number of which are furnished to members only on purchase, and the obtaining of a complete set of the Book of Standards without the extra yearly charge made for two or all three parts (a second complete set, if requested, is furnished without charge). Many of the sustaining members take advantage of the privilege accorded in having the names of some of their technical men who are active in A.S.T.M. work or concerned with materials placed on the ASTM BULLETIN mailing list.

Concerning committee affiliations, sustaining membership carries with it exactly the same privilege as company membership, namely, of designating more than one technically qualified representative to the various committees to which the organization may be appointed.

It is of interest to note that of the some 1400 companies, corporations, associations, and commercial laboratories in A.S.T.M. over 10 per cent are sustaining members. The remaining 3500 members are individuals and others such as libraries, government branches and related departments, teaching faculties, etc.

New Sustaining Members

UNITED AIRCRAFT CORP., E. A. RYDER, CONSULTING ENGINEER, PRATT & WHITNEY AIRCRAFT DIVISION, EAST HARTFORD, CONN.

This organization has been officially represented in the Society since 1929, with Mr. Ryder serving as representative for a number of years. Although the organization has not been represented on a large number of A.S.T.M. committees, Arthur W. F. Green who is well known to a great number of Society people is a member of Committee D-11 on Rubber Products. He has participated in A.S.T.M. activities and has appeared on programs of Society meetings. James H. Bly, Materials Laboratory, Pratt & Whitney, is a personal member of the Society.

LIQUID COOLED ENGINE DIVISION, THE AVIATION CORP., J. H. LAROSE, CHIEF METALLURGIST, TOLEDO, OHIO.

The sustaining membership of this organization which is doing such important work in the aircraft field along with a good many other A.S.T.M. company members is its first corporate membership in the Society and is the second company to become a sustaining member without a previous company contact.

JOHNS-MANVILLE CORP., EARL R. WILLIAMS, MANAGER, RESEARCH LABORATORIES, MANVILLE, N. J.

This large organization has for a great many years been extremely active in a wide range of A.S.T.M. committees and other work. The company membership which has been transferred to the sustaining membership class has been in effect since 1931, but a number of individuals in the company have been affiliated with A.S.T.M. for longer lengths of time, in particular James Driscoll, since 1922, S. Collier, 1926, George W. Clarvoe, 1928, and Kent N. Johnson, 1930. There are several other technical individuals in the company who are also members. The company is active in the work of seven A.S.T.M. standing committees, with a number of technical men serving as representatives and participating in the subcommittee work. At the present time on Committee D-13 are Messrs. C. B. Bradley and Philip D. Cannon. Mr. Berger has for many years served on the committee on bituminous waterproofing and roofing materials. Mr. Williams has represented the company for some ten years on Committee C-5 on Fire Tests of Materials and Construction, Mr. Bradley is on Committees C-8 on Refractories and D-9 on Electrical Insulating Materials, and H. H. Rinehart is very active in the work of Committee C-16 on Thermal Insulating Materials. W. C. Brockway serves on Committee D-4 on Road and Paving Materials.

MICA INSULATOR CO., ROBERT H. SPRY, CHIEF ENGINEER, SCHENECTADY, N. Y.

This organization has been a company member of the Society for 20

years, and has been concerned particularly with the work of Committee D-9 on Electrical Insulating Materials, on which Mr. Spry has served since 1932. Mr. Spry serves on six of the D-9 subgroups. C. P. Mills of this organization, with offices in New York, represents the company on Committee D-9 and also represents the National Electrical Manufacturers Association on this committee.

Baker and Co., Inc., Fred E. Carter, Director of Physics Dept., Newark, N. J.

Doctor Carter, who has been actively concerned with phases of A.S.-T.M. work for a number of years, has represented this organization since 1929. January 1, 1943 marks the fourteenth year that he has been a member of Committee B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys. At the present time he is serving as chairman of its new Subcommittee on Contact Materials. This group has a very active organization on research and specifications work under way, with five organized sections. Serving with Dr. Carter on Committee B-4 is Dr. H. E. Stauss, who has also represented the company since 1932 on Committee E-2 on Spectrographic Analysis.

Crane Co., A. M. Houser, Engineer of Standardization, Chicago, Ill.

This company, by virtue of its membership dating from 1908, ranks as the "oldest" A.S.T.M. member in this list of new sustaining members. At that time, and for almost 25 years, the official representative was John B. Berryman, who was for some time Chief Engineer and then for many years First Vice-President of the company. This organization has participated in and supported very actively many A.S.T.M. activities. Mr. Houser, the present representative, serves on a number of committees. At the present time W. Kliment, Standardization Engineer, is serving as Mr. Houser's alternate while the latter is acting as Deputy Chief, Simplification Branch, WPB Conservation Division, Washington. H. W. Maack, Chief Chemist and Metallurgist, has been a personal member for many years, as has been J. J. Kanter, Materials Research Engineer. J. P. Magos, Directing Engineer of the Research Laboratories, is also a member. The company is, of course, interested in service on the metals committees. Mr. Kanter is active on Committees A-1 on Steel, A-3 on Cast Iron, A-7 on Malleable-Iron Castings, A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys, and on Committee B-5 on Copper and Copper Alloys, Cast and Wrought, where he represents the Manufacturers Standardization Society of the Valve & Fittings Industry. He has been active on the Joint Research Committee on Effect of Temperature on the Properties of Metals.

Phelps Dodge Refining Corp., J. P. Dyer, Vice-President, New York, N. Y.

This organization, among the leaders in the non-ferrous metals field, has been affiliated in a corporate capacity with A.S.T.M. since 1931, Mr. Dyer having served as official representative in recent years. Other organizations in the Phelps Dodge group are active in the Society, including the American Copper Products Division, which affiliation dates from 1909, the Habirshaw Cable and Wire Division, and the American Copper and Wire Products Division, as well as the corporation. The company is active on several of the Society's "B" committees, including Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors. C. S. Harloff serves on Committee B-1 and also on Committee B-2 on Non-Ferrous Metals and Alloys, J. V. Crilly is active on Committee E-3 on Chemical Analysis of Metals, while Curtis Piggott serves on Committee B-5 on Copper and Copper Alloys, Cast and Wrought.

National Malleable and Steel Castings Co., H. W. Gilbert, Manager, Department of Inspection and Tests, Cleveland, Ohio.

Mr. Gilbert, who has taken a very active interest in A.S.T.M. work, has represented this company membership since 1920, and Dr. Harry A. Schwartz, Manager of Research, who also has been active in various capacities, has been a member of the Society since 1907. Dr. Schwartz is Secretary of Committee A-7 on Malleable-Iron Castings, on which he also represents the American Foundrymen's Association. He was the first chairman of the Cleveland District Committee, serving for three terms, and at present he is a member of that group. He has contributed a number of articles to A.S.T.M. technical publications. Mr. Gilbert serves as company representative on Committees A-1 on Steel and A-7 on Malleable-Iron Castings.

The Western Union Telegraph Co., Curt E. Mobius, Assistant to Engineer of Lines, New York, N. Y.

Members of the Society since 1910, this important communication company has been active in a number of technical committees. Mr. Mobius has been particularly concerned with the work of Committee A-5 on Corrosion of Iron and Steel for the past 18 years. W. F. Markley and W. N. Engler have represented the company for many years on Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors. Mr. Markley also serves on Committee D-11 on Rubber Products. R. C. Taylor serves on Committee A-6 on Magnetic Properties, and both Messrs. Mobius and Markley serve on several sectional committees under ASA procedure.

Lever Brothers Co., J. W. Bodman, Research Superintendent, Cambridge, Mass.

This leading organization in the field of soaps and other detergents and related materials dates its membership in A.S.T.M. from 1927. For this period Mr. Bodman has served as the official representative. Mr. Charles H. Black is a representative of the company in several subcommittees of Committee D-13 on Textile Materials, and Dr. L. B. Parsons is the representative on several subcommittees of Committee D-12 on Soaps and Other Detergents, as well as on Committee D-17 on Naval Stores.

Gulf Research and Development Co., Paul D. Foote, Executive Vice-President, Pittsburgh, Pa.

Although the A.S.T.M. affiliation of this company dates from 1938, Dr. Foote personally has been a member of the Society since 1928, and the Society has had other members from the organization. The company is, of course, concerned especially with the activities of Committee D-2 on Petroleum Products and Lubricants, on which Eugene Ayres serves as representative and is chairman of Subcommittee XVIII. Dr. Foote represents his company on Committee D-1 on Paint, Varnish, Lacquer, and Related Products, and Mr. Ambrose, in addition to serving as Secretary of the Pittsburgh District Committee, is also a representative on Committee D-2 and on Committee D-9 on Electrical Insulating Materials. B. B. Wescott serves on Committee E-7 on Radiographic Testing.

Lone Star Cement Corp., H. R. Durbin, Chief Chemist, New York.

This organization has been affiliated with A.S.T.M. for many years, with Mr. Durbin being connected either personally or as company representative since 1919. Lone Star Cement Corp. has been particularly interested in the Society's work in the field of cement, concrete, and concrete aggregates. A number of the company's technologists have been members of the Society for long periods of time; L. R. Ferguson was affiliated for almost 35 years, and Myron A. Swayze has been a member for 18 years. Mr. Swayze, Director of Research at the Company's Hudson New York plant, has been particularly concerned with the activities of Committee C-1 on Cement and served on the A.S.T.M. Executive Committee. H. A. Sawyer, Vice-President at New Orleans, has been a member since 1934. The company's South American interests are also represented in the Society, Mr. E. Belling of Buenos Aires having been a member since 1928, and Mr. L. Hoffman, at Argentina, since 1932.

The Lunkenheimer Co., Charles A. Brown, First Vice-President and General Manager, Cincinnati, Ohio

The company membership maintained by this leading organization has been in effect since 1936, during which time Mr. Brown has been the official representative, but the company has been represented in the Society for over 35 years through the personal affiliation of some of its technical people. J. W. Bolton, Director of Metallurgical Research and Testing, has been a personal member since 1926, and is active in numerous technical committees. He is the chairman of Committee A-3 on Cast Iron and a member of several of its subgroups; secretary of the Joint Research Committee on Effect of Temperature on Properties of Metals; and has been a member for fifteen years of Committee B-5 on Copper and Copper Alloys, Cast and Wrought, and of Committee A-1 on Steel since 1930. On some of these committees he also represented the Manufacturers Standardization Society of the Valve and Fittings Industry. He has presented a number of technical papers which are published in various Society volumes.

Western New York-Ontario District Committee Organized

THE ORGANIZATION meeting of the recently appointed Western New York-Ontario District Committee was held in Buffalo at the Hotel Statler on Tuesday night, January 12, 1943. An informal reception and get-acquainted hour was held from 5:30 to 6:30 followed by a dinner at 6:30 and the organization meeting.

Mr. B. L. McCarthy, Wickwire Spencer Steel Co., acted as temporary Chairman on appointment of the Executive Committee. R. E. Hess, A.S.T.M., Assistant Secretary, was in Buffalo for the occasion.

The members of the District Committee are as follows:

- T. H. Adair, Atlas Steels Ltd., Welland, Ont., Canada
- E. H. Branson, Director of Research Laboratories, General Railway Signal Co., Rochester, N. Y.
- T. J. Brown, Chairman, Department of Chemistry, Canisius College, Buffalo, N. Y.
- D. D. Crandell, Director of Research, National Gypsum Co., Buffalo, N. Y.
- O. W. Ellis, Director, Department of Engineering and Metallurgy, Ontario Research Foundation, Toronto, Ont., Canada
- L. V. Foster, Optical Engineer, Bausch & Lomb Optical Co., Rochester, N. Y.
- W. H. Lutz, Technical Director, Pratt & Lambert, Inc., Buffalo, N. Y.
- I. C. Matthews, Research Chemical Engineer, Research Laboratories, Eastman Kodak Co., Rochester, N. Y.
- T. L. Mayer, Head, Department of Technology, Buffalo Public Library, Buffalo, N. Y.
- B. L. McCarthy, Chief Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.
- J. G. Morrow, Metallurgical Engineer, The Steel Co., of Canada, Ltd., Hamilton, Ont., Canada
- O. M. O'Neill, Chief Chemist, Niagara Alkali Co., Niagara Falls, N. Y.
- F. A. Porter, Doehler Die Casting Co., Batavia, N. Y.
- Willard H. Rother, Metallurgist, Buffalo Foundry and Machine Co., Buffalo, N. Y.
- Louis Shnidman, Laboratory Director, Rochester Gas and Electric Corp., Rochester, N. Y.
- C. F. Smith, Jr., Rubber Technologist, U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y.

After the meeting was called to order at 8:30 p.m. by the temporary chairman and Mr. Hess had outlined the purpose of the formation of district committees, the following officers were elected:

Chairman: B. L. McCarthy   Secretary: T. L. Mayer
Vice-Chairmen: O. W. Ellis, I. C. Matthews

The committee voted to have by-laws to govern the activities of the District Committee and the following members were appointed to that committee.

W. H. Lutz, Chairman, T. L. Mayer, B. L. McCarthy

It was agreed that there should be at least three standing committees, a Finance Committee, Program Committee, and Membership Committee. Chairman McCarthy then appointed the following committee members:

Finance Committee	*Membership Committee*
T. J. Brown, Chairman	C. F. Smith, Jr., Chairman
O. M. O'Neill	E. H. Branson
L. V. Foster	T. H. Adair

Program Committee:

It was agreed that the Chairman and the two Vice-Chairmen should serve as a program committee namely:

B. L. McCarthy, Chairman, O. W. Ellis, I. C. Matthews

It was recognized that further temporary additions could be added to the Program Committee to take care of special meetings.

A general discussion of the purposes and plans for the District activities followed and it was generally agreed that at least one meeting a year should be held by the District Committee but three should be the number to strive for. It was further agreed that meetings should alternate between Rochester, Buffalo, and Hamilton or Toronto. Close cooperation with other technical societies in the district was stressed and a plan for broad publicity of meetings should be considered.

It was agreed that the first meeting of the District Committee should be held in the form of a dinner meeting in conjunction with the A.S.T.M. Spring Meeting in

Members at organization meeting of new Western New York-Ontario District Meeting

From left to right, back row: F. A. Porter, Doehler Die Casting Co.; W. H. Lutz, Pratt & Lambert, Inc.; L. V. Foster, Bausch & Lomb Optical Co.; T. J. Brown, Canisius College; O. M. O'Neill, Niagara Alkali Co.; Front row: Mr. Hoyt (for C. B. Smith), U. S. Rubber Reclaiming Co., Inc.; O. W. Ellis, Ontario Research Foundation; B. L. McCarthy, Wickwire Spencer Steel Co.; I. C. Matthews, Eastman Kodak Co.; T. H. Adair, Atlas Steels, Limited.

Buffalo (see page 5). This dinner meeting is scheduled for March 3, 1943.

It was proposed that a speaker of national interest be obtained and other noteworthy individuals be invited to be present. If possible either the President or one of the Vice-Presidents of the Society will be present.

A discussion on finances followed and various ways and means of financing the new district were discussed.

In appointing members to the District Committee, the Society officers had in mind the rather wide diversification of industry in this area and also endeavored to give adequate representation to Rochester and the Province of Ontario. In the district area in addition to Buffalo, Rochester, and Toronto are such communities as Corning, Niagara Falls, Jamestown, Alfred, and Geneva. In Canada industrial centers such as Hamilton, St. Catherine's and Welland are represented. Of the 171 members and committee members in the District 53 are located in the Province of Ontario.

With the organization of this new District Committee, there are now ten industrial centers which have such groups. They are responsible for promoting interest in the activities of the Society, holding periodic meetings, stimulating membership, and in various ways, which differ somewhat depending on the community and various industries dominant, aid in the Society's work involving standardization of specifications and tests and promotion of knowledge of materials.

Pittsburgh District Meeting

A MEETING SPONSORED by the Pittsburgh District Committee was held at Mellon Institute on Monday evening, January 11. To a very interested audience, Secretary C. L. Warwick outlined the functioning of the Specifications Branch of the Conservation Division of the War Production Board and its relation to the service organizations and other branches of the Government. His talk developed the importance that specifications play in the efforts to conserve critical materials with particular mention of design codes that have recently been issued covering design of reinforced concrete buildings. Work is now under way in similar considerations with respect to timber structures.

In all of the work of the Specifications Branch, specifications of existing agencies such as the A.S.T.M. are most helpful and play an important part.

Dr. F. W. Adams, Industrial Fellow at Mellon Institute, then presented in the form of a movie film, with running comment by the speaker, results of an extensive investigation of the effects of blasts such as from aerial bombs on window glass. This investigation treated the subject not only from the point of view of the testing of regular window glass, but also an evaluation of the effectiveness of various means of protection, as, for example, protective films, tapes, etc. This investigation should be of considerable assistance in connection with Civilian Defense activities. It is planned to publish in a later issue of the ASTM BULLETIN a paper by Dr. Adams covering the subject.

Mr. A. R. Ellis, President, Pittsburgh Testing Laboratories, and Chairman of A.S.T.M. Pittsburgh District Committee, arranged the program for the meeting, and with H. A. Ambrose, Gulf Research and Development Co., who is Secretary of the Committee, handled the various meeting arrangements. Invitations to attend the meeting had been extended to a number of Civilian Defense Offices in the Pittsburgh area.

Philadelphia Meeting on Plastics—Messrs. Bigelow and Bates to Speak

UNDER THE AUSPICES of the A.S.T.M. Philadelphia District Committee there is being held on Wednesday, February 10, at the Franklin Institute on the Parkway, a meeting on plastics to be featured by two outstanding authorities in this field—Captain M. H. Bigelow, Office of Technical Command, Chemical Warfare Service, Edgewood Arsenal (formerly Director of Technical Service, Plaskon Co., Inc.) and member of the A.S.T.M. Executive Committee, and Dr. A. Allan Bates, Manager, Chemical and Metallurgical Department, Westinghouse Electric and Manufacturing Co., Research Laboratories, East Pittsburgh, Pa. Both men are forceful and effective speakers.

A number of other people in the plastics industry are being contacted and all members and people in the Philadelphia area and elsewhere are cordially invited by the District Committee to attend.

This field, in which A.S.T.M. Committee D-20 on Plastics is doing such important work, is one of primary interest to large numbers of engineers from all branches of industry.

L. J. Markwardt to Speak at Chicago District Meeting on Timber Research

L. J. MARKWARDT, Chief, Division of Timber Mechanics, U. S. Forest Products Laboratory, Madison, Wis., will address the Chicago District members of the Society on Thursday, February 4, in the Auditorium of the Engineers Building, Wacker and Wells St., Chicago, on "Recent Progress in Timber Research" in which field he is an outstanding authority and leader. This meeting is jointly sponsored with the Western Society of Engineers. It is important to note that the meeting begins at 7 o'clock promptly.

Mr. Markwardt, at the present time in charge of extensive research on war problems, has been active in the timber field for some 30 years. He will cover latest developments in microscopic structure; chemical seasoning (a revolutionary drying method); glue developments—opening new horizons; plywood technique—versatility in application; resin impregnation, with compression—a new material results; connectors; laminated construction; structural grading principles; and housing research progress. While the subject is basically timber, the remarkable developments in this field have resulted in numerous products that are really new materials. Consequently, the talk is of interest to practically every engineer and technical man and the Chicago District Committee has extended a cordial invitation to everyone interested to attend.

Committee A-1 on Steel Meets

EXCELLENT ATTENDANCE, spirited discussion on several points, and a number of important specification actions in several steel product fields marked the series of meetings of Committee A-1 on Steel held on January 20 and 21 at the Hotel Warwick in Philadelphia. Two national emergency steel groups met and a Section on Clad Plate of Committee A-10 also took advantage of the opportunity to meet, making a total of eleven committee meetings. Some 110 members registered for the meetings. Subcommittees on pipe, materials for high-temperature service, forgings, steel castings, and wheels and tires each had well attended and lengthy meetings. Most actions were taken subject to confirming letter ballot vote.

Steel Forgings:

The work of the National Emergency Steel Specifications group on heavy forgings, which cleared its seven specifications and some emergency provisions through Subcommittee VI of Committee A-1, was briefly discussed and the NESS group commended for its outstanding job. (A news account of these emergency specifications appears in another part of this BULLETIN.) Agreement was reported on the part of a special NESS section on specifications for carbon and alloy steel blooms and billets for heavy forgings. With respect to the A.S.T.M. billet and bloom specification, A 248 - 41 T, Subcommittee VI decided to leave this in its present status as tentative pending further clarification of carbon and particularly alloy requirements. The ring and disk forging specification, A 243, which by June will have remained two years without action is to be voted on for adoption as standard since it has been in use for two years without serious criticism.

Wheels and Tires:

The discussion at this meeting concerned existing emergency alternate provisions in certain of the wheel specifications, in particular the simplification of wheel sizes and designs which have been reduced from several hundred to some fifty recognized sizes. Minor clarification of dimensions of wheels over 44 in. in diameter will be made in the next printing of A.S.T.M. Specifications A 57, covering multiple wear wheels.

Castings:

Much of the discussion in Subcommittee VIII on Steel Castings concerned the practicability of including in specifications requirements on tests and properties for use at subatmospheric temperatures in the neighborhood of −40 to −60 F. A number of consumers and producers commented on the use of Charpy and Izod impact tests, nature of notch results, the validity of results, etc. The question of a brittleness transition range at low temperature which apparently has been established by Davidenkof, the Russian, was mentioned. Possibly a solution to the problem would be to set up qualification tests for producers with periodic control tests which might involve the use of the Charpy test at certain temperatures. Recent tests at Watertown Arsenal indicate that size of specimen is not a governing factor but that the general trends with smaller size specimens carries through on the larger size. For a particular material with major factors comparable, the low-temperature impact test was deemed to give satisfaction as a check on quality.

Castings at High-Temperature Service.—The one question which came in for most intense discussion in the high-temperature casting section which functions under Subcommittee XXII was the use of converter steel for valves and fittings. A special subcommittee had brought in a report recommending no change in the process clause of the existing specifications and after lengthy discussion a motion carried to adopt the report.

A new emergency grade of carbon steel is to be recommended for valves and fittings in Specifications A 216 covering weldable carbon steel castings. The present "pink slip" gives emergency grades which, however, are applicable only for pressure containing turbine castings. Another emergency casting grade is to be established in the basic valve Specifications A 95. In both standards the grades must have a tensile strength of 60,000 psi., yield point 35,000 psi., elongation in 2 in. of 20 per cent, and 30 per cent reduction of area.

Bolting:

An important new specification covering heat-treated carbon steel bolting material intended to give some relief from the stringent alloy situation was approved for letter ballot vote. The material covered is limited to 2-in. and under in diameter for pressure vessels, valves, flanges, and fittings for high-temperature service. The material must conform to a minimum tensile strength of 100,000 psi., yield point of 75,000 psi., elongation in 2 in. of 16 per cent, and reduction of area of 45 per cent. The required chemistry is 0.55 per cent carbon maximum, 0.90 per cent manganese, 0.04 per cent phosphorus, 0.05 per cent sulfur, 0.15 to 0.30 per cent silicon.

Pipe and Tubing:

While there was extended discussion on a number of A.S.T.M. pipe specifications in the charge of Subcommittee IX, it resulted in relatively few modifications. Proposals to eliminate schedule numbers from certain specifications were not passed but some editorial corrections in sizes and weights are to be incorporated. In several specifications which carry reference to A.S.A. pipe thread standards, reference will also be made to the Bureau of Standards Handbook H 28, indicating that data in this book and the A.S.A. document are identical. Specifications for Electric Fusion Welded Pipe, A 139, will be changed to indicate its applicability for 4 to 30 in O.D. pipe eliminating the present restrictions beginning at 8 inches. A special section was instructed to make a study of electric-resistance-welded pipe standards in $^1/_8$-in. and $^1/_4$-in. sizes for which there is considerable demand.

Proposed emergency alternate provisions in the specifications for electric-resistance-welded steel heat-exchanger and condenser tubes, A 214, would permit the purchase of unnormalized tubes with a maximum Rockwell of B 80 and an alternate method of nondestructive electrical testing in lieu of hydrostatic testing, with a further change in flattening test requirements. This and, of course, all

other changes at the meeting are subject to confirming letter ballot vote.

In the absence of N. L. Mochel, Chairman of the Committee, who was on the Pacific Coast on emergency matters, the Vice-Chairman, H. B. Oatley, Vice-President, Superheater Co., presided at the meeting.

Committee A-5 Engages in the "Battle of the Scrap"

WHILE THERE have been some happenings and incidents affecting some of the A.S.T.M. corrosion test racks and specimens of which there are a good many on exposure at various sites throughout the country, the valuable tests sponsored by Committees A-5 on Corrosion of Iron and Steel, B-3 on Corrosion of Non-Ferrous Metals and Alloys, and other groups are continuing. Some minor shifts in location were necessary at Annapolis and Key West, and some time ago the inconsiderate rising water of the Ohio River overflowed the test site at Pittsburgh (Brunot Is.) and the most recent happening has been the contribution (?) of a very zealous individual to the scrap drive of the hardware samples at Altoona. With so many test sites and various conditions at each, there has been, however, a minimum of disturbance of the specimens and racks. Anyway most of the samples lost at Altoona had rusted to a degree that Committee A-5 does not bemoan their loss, but does feel a little sorry that the reclamation squad did not get there in time to salvage a few selected ones.

One problem which always confronts those responsible for the tests is the maintenance and upkeep of the test racks which depending on the construction apparently suffer with the specimens. Recently through the energy and interest of the Chairman of Committee A-5, C. D. Hocker of Bell Telephone Laboratories, Inc., needed repairs have been completed for the hardware racks at Sandy Hook and State College, Pa. With some help and the comfort of a bonfire one wintry week end Dr. Hocker personally repaired the racks and the specimens are continuing on exposure. The ones which were not worth salvaging—several hundred pounds of steel—were intentionally steered into the scrap collection.

Chart Assists in Conservation of Critical Materials

A DOWN-GRADING chart which will guide engineers and designers in specifying lower grades of critical material for brass and bronze castings was issued recently by the Specifications Branch, WPB Conservation Division. The use of the down-grading chart for conservation in brass and bronze castings by specification change was explained by Carter S. Cole, Chief, Metals Section, Specifications Branch.

Real conservation can be effected by specification changes based on a critical engineering examination of end use. The primary objective of this work is a better utilization of available material for maximum efficiency in the war effort. Numerous L and M orders have shut off copper, tin and other scarce materials from nonessential civilian purposes. Even with this, taking the picture as a whole and more specifically referring to the primary metals, we do not have sufficient for our direct and indirect military needs and for items directly concerned with health and safety.

When copper, tin and other metals were cut off from their civilian uses some of the normal channels in which these materials regularly flowed were closed. As a consequence lower grades of secondary material are relatively much more available than primary metals. Brass mill scrap on the other hand has been routed back to the brass mills for reprocessing. In normal times, copper clippings and similar high purity scrap were used to sweeten, or upgrade, casting alloys. So the ingot makers and the foundrymen have had to work with materials having higher impurities than those to which they were accustomed.

In this connection specifications have been carefully reviewed by Army, Navy and Federal Specification Committees, the American Society for Testing Materials, and the Society of Automotive Engineers. Others, too, have cooperated, including many of our largest industrial companies that write their own specifications. In liberalizing specifications, requirements for virgin metal have been removed, impurity limits have been raised, and specifications for new alloys written so that material currently available could be used to better advantage. The materials engineer has thus given the designing engineer the tools with which he may work. It is the designing engineer's responsibility from here on to make use of these

tools in the most effective manner possible. The accompanying chart can serve as his guide and the table below it gives a ready cross-reference to the applicable approximately equivalent specifications.

The chart shows most of the important specifications grouped in columns according to the material required by an ingot maker or foundryman. Four classifications are given. "All New Metal" includes No. 1 and No. 2 copper as well as electrolytic. "High Purity Secondary" is exemplified by such items as fired cartridge cases currently used to make regular manganese bronze. In any specification where the lead is equal to or greater than the tin, the tin content of bronzes can generally be introduced into the alloy from secondary sources such as sweated or unsweated radiator cores. Lead is generally the contamination of our secondary supply that restricts the use of material in our tighter specifications. Such in general are the considerations governing our source of supply of material to make the various grades of brass and bronze castings.

The designer, in the past, has given little or no thought to conservation but has specified the best material for the purpose intended. Composition "G," or Gun Metal, has many important and traditional uses. In peace times when our supply of raw materials was unrestricted there could be little criticism of a designer who specified this excellent metal for many and varied uses. Today, however, the 0.2 or 0.3 per cent lead maximum in specifications for this bronze places it in a class requiring primary copper and tin for its manufacture. Now the designer must revise his thinking and specify the least restrictive material that will do the work at hand.

As indicated on the chart, in many instances Composition "M," or even 85-5-5-5[1] will give adequate service performances for many items where Composition "G" has been specified. The Armed Services are recognizing this and have made many specification changes of this nature which conserve primary metal. The Navy, for instance, last spring issued a directive permitting the use of Composition "M" in place of Composition "G" in pressure castings. The Maritime Commission has changed propeller shaft sleeves from "G" to "M," an alloy on which the Navy had standardized for this purpose.

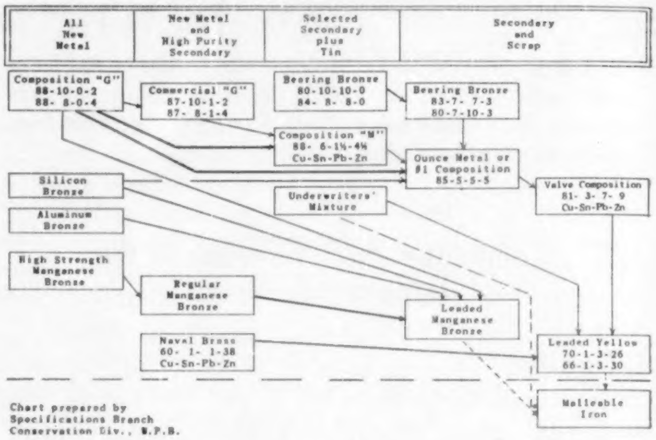
More recently the Navy has pointed out the possibilities of the use of 85-5-5-5 for Composition "M," Composition "G," or silicon bronze for sea water valves and fittings. It might also be noted that where structural strength is the primary consideration, leaded manganese bronze is an excellent design choice, in place of Composition "G," silicon bronze, or aluminum bronze.

There are times, of course, when a partial or full substitution of ferrous metal may be made for some of the non-ferrous alloys—even in some uses directly or indirectly connected with our war effort. Such, for instance, is the current use of malleable iron tail-pieces for fire hose couplings that formerly were made of the Underwriters mixture. Swivels, and couplings used aboard ship, are retained in a non-ferrous metal. The alloy used, however, is a common leaded yellow brass that can be made entirely from secondary material and scrap.

Other possible design changes are shown on the chart and those which are currently most desirable are indicated

[1] These values are expressed in order of copper, tin, lead, and zinc. Thus 70 - 1 - 3 - 26 equals 70 per cent copper, 1 per cent tin, 3 per cent lead, and 26 per cent zinc.

DOWN-GRADING CHART FOR BRASS AND BRONZE CASTINGS
SHOWING SPECIFICATIONS AND MATERIAL REQUIREMENTS



SPECIFICATIONS					
ALLOY	ASTM	ARMY & FEDERAL	NAVY	AMS	SAE
Composition "G"	B 143, 1A & 1B B 60	QQ-B-691a - 5	46M 6g "G"	4845 A	62
Commercial "G"	B 143, 2B E-B 143, 2X	QQ-B-691a - 6	46B 5h "P-c"		
Composition "M"	B 143, 2A B 61	QQ-B-691a - 1	46B 8g "M"		
85-5-5-5	B 145, 4A B 62	QQ-B-691a - 2	46B23c "Oz-c"		40
81-3-7-9	B 145, 5A	QQ-B-691a -11	46B24d		
80-10-10	B 144, 3A			4842	64
84- 8- 8	E-B 144, 3Y	QQ-B-691a - 8	46B22d "II"		
83- 7- 7-3	B 144, 3B	QQ-B-691a - 12			660
80- 7-10-3	E-B 144, 3X				
Naval Brass	B 146, 6C	QQ-B-621 - A	46B10f "N-c"		
70- 1- 3-26	B 146, 6A E-B 146, 6X & 6Y	E-QQ-B-621 X & Y	46B11(INT)		
66- 1- 3-30	B 146, 6B	QQ-B-621 - B	46B11(INT)		41
Silicon Bronze		QQ-C-593	46B28(INT)		
Aluminum Bronze	B 148, 9A & 9B	QQ-B-671a	46B18c		68
Underwriters' Mixture		WW-C-621a	34F 3c		
H. S. Manganese	B 147, 8B	QQ-B-726b B & C	46B29 "MA-c"	4862	
Regular Manganese	B 147, 8A	QQ-B-726b - A	49B 3e "Mn-c"	4860	43
Leaded Manganese	B 147, 7A	QQ-B-726b - D			

NOTE: Specifications, as shown, are approximately equivalent but may not in all cases be interchangeable for procurement and inspection.

January 1, 1943

by the use of heavier connecting lines. Results to date have been very encouraging. Much progress has been made. The actual saving in primary copper by specification changes is already measured in terms of thousands of tons per month. Much more still remains to be done. It is work in which all who are connected with the war effort can cooperate. In this the Conservation Division of the War Production Board will gladly be of assistance. But it is primarily a challenge to the design engineer to see that by a closer examination of end use he secures the best possible utilization of our material resources to win this war.

Study of Cast Iron at Elevated Temperatures

THE WAR METALLURGY Committee in cooperation with the American Foundrymen's Association has been developing information on the use of cast iron at elevated temperatures, that is, in excess of 450 F. Since this is a problem in which A.S.T.M. Committee A-3 on Cast Iron is very definitely interested and since one of the ultimate objectives is the formulation of specifications to cover such applications, a subcommittee is being organized to develop and review pertinent data. Requirements for unfired pressure vessels limit pressure for cast iron to approximate 160 psi. and a top temperature of 450 F. J. S. Vanick, The International Nickel Co., 67 Wall St., New York, is heading up the new A-3 subcommittee, which is being organized in various groups and is in close touch with the American Foundrymen's Association. Members having data on the application of cast iron at elevated temperatures or who are directly concerned with this work are urged to get in touch with Mr. Vanick.

XXIX. Long-Time Society Committee Members

Twenty-ninth in the Series of Notes on Long-Time Members

As a continuation of the series of articles in the ASTM Bulletin comprising notes on the outstanding activities of long-time A.S.T.M. members, there are presented below outlines of the work of three additional members. In general, the men whose activities are described in this series have been affiliated with the Society for 25 years or more and have taken part in committee work for long periods of time. No definite sequence is being followed in these articles.

R. B. Harper H. J. Jaquith H. C. Porter

H. J. Jaquith, Minot, Hooper & Co., New York, N. Y., is one of quite a number of A.S.T.M. members whose technical abilities and skills were developed through practical experience predominately and not based on extensive scholastic training. He received his education in the East Orange Grammar and High Schools, and has been with his present company since 1892, when he started with the organization as an office boy. During the first World War he was in charge of extensive Government contracts with his company, handling the products of five large mills and has had charge of Government work since then. Mr. Jaquith has been a very loyal participant in A.S.T.M. work, particularly, of course, in the textile field where his company is a leading dry goods commission merchant.

Mr. Jaquith was one of the founder members of Committee D-13 on Textile Materials, and because of his contacts with the early work of the committee, he in 1939 wrote the historical sketch which was read at the D-13 Twenty-fifth Anniversary Meeting and which is published in the compilation of textile standards for 1939. He was vice-chairman of D-13 from 1924 to 1926, and has served on a large number of its subcommittees and sections. He has been a member of the A.S.T.M. New York District Committee since 1938, and represents the Society on the Sectional Committee on Specifications and Standards for Sheets and Sheeting (ASA L 4) functioning under American Standards Association. He is also active in the work of the Textile Research Institute.

Mr. Jaquith is a member of that rather extensive group of A.S.T.M. members whose technical interests are confined pretty largely to one materials field, but whose sustained and active interest in this field means so much to A.S.T.M.

R. B. Harper, Vice-President, The Peoples Gas Light and Coke Co., Chicago, Ill., a native of Indiana, received his education in Chicago schools and took a general science course at the University of Chicago and later graduated from the Armour Institute of Technology with the Bachelor of Science degree in Chemical Engineering in 1905, receiving his advanced degree in 1909. Since his graduation from Armour in 1905 he has been affiliated with his present company. He was Chemist in charge of Laboratory in 1906, Chief Chemist and Chemical Engineer in 1917, Chief Testing Engineer and Superintendent of the Testing Department in 1924, and since 1930 has been Vice-President in charge of Research and Testing.

In the Society, Mr. Harper has been very active, particularly in the work of Committee D-3 on Gaseous Fuels. He is chairman of its Subcommittee III on Determination of Calorific Value of Gaseous Fuels, and serves on the Advisory Committee. He has also been a member of Committee A-3 on Cast Iron for eleven years, and has served on the A.S.T.M. Chicago District Committee since 1935.

As might be expected for one who is an outstanding authority in his field, Mr. Harper has been extremely active in a great many organizations, has received numerous honors, has presented a large number of addresses and papers and talks. He has been particularly interested in the work of the Armour Institute of Technology, was a Trustee for many years, has been Director and Treasurer of the Armour Research Foundation, was the Incorporator of the Institute of Gas Technology, and is a Trustee of the Illinois Institute of Technology.

He was active in solving technical problems during the first World War.

Some of the medals and honors awarded Mr. Harper are the Beal Gold Medal of the American Gas Association in October, 1931, for the best technical paper presented to the Association during its 1930–1931 year; the American Association for the Advancement of Science elected him to the title of Fellow in its membership in 1933; the Walton Clark Gold Medal of the Franklin Institute, in May, 1938,

> "in consideration of his leading part in the development, supervision and direction of a research and testing laboratory of outstanding excellence in the gas industry, his cooperation personally, and through members of his staff, with the gas industry generally, and his own distinguished work in the chemistry and physics of the gas industry."

He also received the Distinguished Service Award as a Chemical Engineer from the Alumni Association of Armour Institute of Technology, in June, 1939.

Mr. Harper is a member of some fifteen leading technical societies, including several in the chemical and gas fields, and the list of other organizations of which he is a member is extremely extensive, including numerous Chicago clubs and associations.

H. C. Porter, Chemical Engineer and Chemist, Philadelphia, Pa., was educated at the University of Illinois (1899 and 1900) and received his Ph.D. degree from Harvard in 1903. His industrial connections have included the Solvay Companies of Syracuse, and from 1915 to 1920 he was with the Koppers Co. in Pittsburgh. Previous to this he had been a member of the staff of the Bureau of

Mines Experiment Station in Pittsburgh. From 1917 to 1919 he was in the U. S. Army Ordnance Department concerned particularly with production and supply of raw materials for explosives.

His work as a Consultant and Expert Witness since 1920 has concerned mainly coal, oil and gas, their production, handling and use, and with explosions and explosion risks, whether of gases, vapors, or dusts. An important phase of his investigative work has had to do with combustion and ignition, and the mechanism of these processes in industrial furnaces, as well as in accidental fires and explosions.

A member of the Society since 1914, he has been a member for over 20 years of Committee D-5 on Coal and Coke, has served as vice-chairman of this committee since 1933, and has served on Committee E-8 on Nomenclature and Definitions since 1921. On the coal committee he has been particularly concerned and active in the work on plasticity and swelling, and has specialized in studies of coal carbonization from both its scientific angles and industrial applications. Doctor Porter has taken a leading part in efforts, admittedly difficult, to define such terms as coke, net calorific value or heat of combustion, gross calorific value, etc., and has served as chairman of subcommittees developing these definitions.

In addition to A.S.T.M., he is a member of the American Gas Association, American Chemical Society (chairman of Philadelphia Section in 1925, National Councilor from Philadelphia Section since 1924) and American Institute of Chemical Engineers. He is the author of the book "Coal Carbonization" American Chemical Society Monograph, published in 1924 by Reinhold Publishing Corp., New York, now being rewritten for a new edition; also author of a chapter in Marks' Mechanical Engineers' Handbook on Carbonization and Gas Making, and of an article in Encyclopedia Brittanica (last edition) on Coke and Coke-making.

Poisson's Exponential Binomial Limit

These extensive tables computed and checked by many individual members of the Bell Telephone system were originally used in the solution of problems of telephone trunking, but are of interest to technical men as useful and necessary tools in handling inspection data and in quality control. Since quality control is of such importance today in the production of war material, appearance of the tables is particularly timely. They were arranged by E. C. Molina, Switching Theory Engineer, and there is a short discussion by H. F. Dodge, Quality Results Engineer. They are in two parts, individual terms and cumulated terms. The book in heavy paper cover comprises some 60 pages and can be obtained from D. Van Nostrand Co., Inc., 250 Fourth Ave., New York, N. Y., at a cost of $2.75.

Magnesium and Its Alloys

"The Technology of Magnesium and Its Alloys," a publication recently received at A.S.T.M. Headquarters, is an English translation from the original German and makes available to English-speaking readers a considerable fund of knowledge and experience gathered by the German authors of the original, with certain additions and improvements in the English translation prepared by members of the technical staffs of the companies which have led in the development of the magnesium industry in the British Empire.

The subject of magnesium and its alloys is comprehensively covered, with some of the general topics including the following: raw materials; methods of producing magnesium; physical and mechanical properties of the pure metal and its alloys; metallography of magnesium and its alloys; chemical behavior and corrosion; production of magnesium castings, forgings, rolled parts, machined parts, etc.; magnesium as an alloying element; chemical analysis of magnesium and its alloys; and a summary of patent specifications covering the production, fabrication, and utilization of magnesium and magnesium alloys.

This book contains a total of 536 pages, and is illustrated with 524 photographs and illustrations. Durably bound in maroon canvas, it is obtainable from F. A. Hughes & Co., Ltd., Clifton Junction, Swinton, Manchester, for 30 *s.* per copy plus 1 *s.* 3 *d.* postage.

British Methods for Testing Petroleum and Its Products

Many A.S.T.M. members will be interested in the 1942 (Fourth) Edition of the Standard Methods for Testing Petroleum and Its Products published by the Institute of Petroleum (British). Republication of the book was desirable because the complete stock of the former edition was destroyed by enemy action and opportunity was taken completely to revise this book. An attempt has been made to include all test methods required in official specifications, particularly those of the Navy, Army, and RAF.

Various tests have been kept as closely as possible in accordance with those of the A.S.T.M.; a number of the methods given were developed through the work of Committee D-2 on Petroleum Products and Lubricants.

The preface notes "it is hoped that even closer cooperation between the A.S.T.M. Committee D-2 and the Institute of Petroleum Standardization Committee can be effected in the future as a result of more direct contacts between the individual subcommittees working on the same problems."

The complete personnel of the Standardization Committee of the Institute of Petroleum responsible for the publication, is listed.

It is of interest to note the new system of serial designations which has been adopted. To avoid confusion a table is given comparing the old and the new designations.

There are 75 methods given, two specifications covering petroleum spirit and thermometers, and a detailed subject index.

A.S.T.M. Headquarters has a supply of the publication and copies can be obtained, postage prepaid, at $3.00 per copy.

Partial List of Emergency Alternate Federal Specifications

From the very large list of Emergency Federal Specifications received at A.S.T.M. Headquarters there has been selected many which it is believed would be of concern to a reasonable cross-section of the Society's membership and the titles of these are given below. Constantly these emergency specifications are being issued, some to supersede previously issued emergency documents—in all cases, of course, the object is to expedite procurement or to conserve strategic or critical materials.

Partial List of Emergency Alternate Federal Specifications

Specification Number	Description
E-C-F-201b	Felt Hair
E-HH-F-191a	Felt; Asphalt-Saturated, (for) Flashings, Roofing, and Waterproofing (superseding December 23, 1942)
E-HH-P-46	Packing; Asbestos, Sheet, Compressed (superseding April 21, 1942)
E-HH-P-96a	Packing, Fiber; (for) Lubricating and Fuel-Oil
E-HH-P-106a	Packing; Flax-Tow
E-NN-B-621a	Boxes; Wood, Nailed and Lock-Corner
E-QQ-B-71a	Bars; Reinforcement, (for) Concrete
E-RR-F-221	Fencing; Wire (Barbed, Netting, and Woven), Black and Galvanized (superseding May 12, 1942)
E-RR-R-571	Rope; Wire (superseding September 2, 1942)
E-TT-R-251a	Remover; Paint and Varnish (Organic-Solvent-Type)
E-TT-T-266	Thinner Lacquer
E-UU-P-31a	Paper; General Specifications (superseding June 25, 1942)
E-UU-P-271	Paper; Kraft, Wrapping, Waterproofed (superseding November 3, 1942)
E-UU-P-465	Paper; Printing, Book, Machine-Finish (superseding June 25, 1942)
E-WW-P-421	Pipe, Water, Cast-Iron (Bell and Spigot)
E-ZZ-S-311a	Sheeting; Rubber (superseding July 28, 1942)

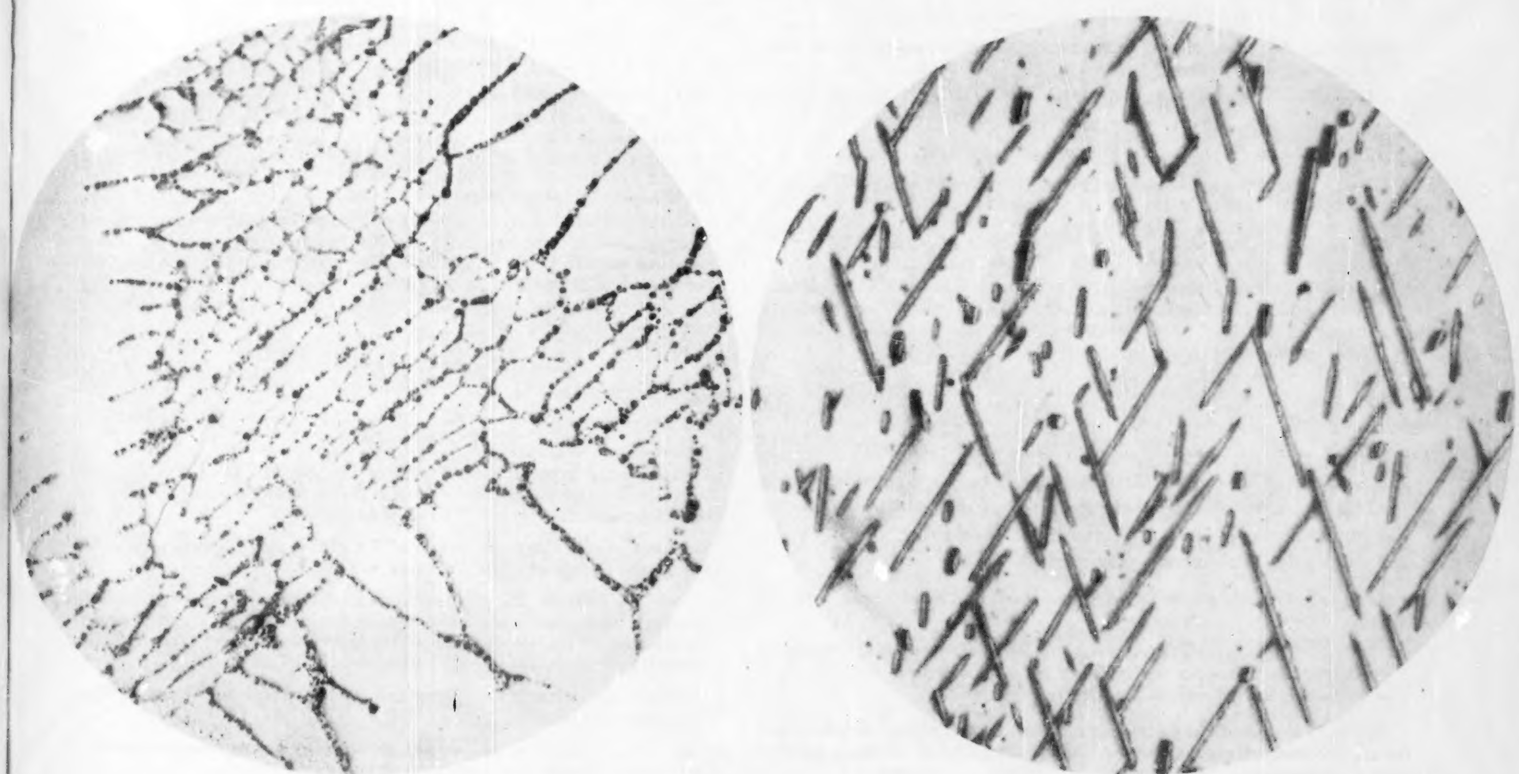
Conference on Electron Microscopy Organized

Evidence of the rapidly growing interest in the field of electron microscopy, in which field there have been several interesting papers published in the ASTM Bulletin and other A.S.T.M. technical publications, is shown by the organization of a national conference on electron microscopy in which leading workers participated. R. Bowling Barnes, Stamford Research Laboratories of American Cyanamid Co., has been elected first President of the conference and the other officers are as follows: Albert F. Prebus, Ohio State University, Vice-President, and Charles Banca, R.C.A. Manufacturing Co., Secretary-Treasurer. V. K. Zworykin, R.C.A. Manufacturing Co., and O. S. Duffendach, University of Michigan, were elected to serve with the officers of the conference as its directors.

The conference was organized during the National Chemical Exposition in Chicago, November 27 and 28, at which there was a very extensive display of electron micrographs showing the wide extent of the applications of this valuable scientific instrument. It is interesting to note that 76 people registered at the meeting at which the conference was organized, all of whom are actively working on electron microscopy. This is indicative of the keen interest in this work.

Prize-Winning Photomicrographs

Left, Cast Zinc Containing Lead (× 170)—Second Prize. *Right*, Widmanstätten Structure in Zinc Containing 1.5 Per Cent Copper (× 1700)—First Prize. Both by Messrs. J. L. Rodda and C. W. Bartholomew, The New Jersey Zinc Co. Entered in the 1941 A.S.T.M. Photographic Exhibit.



EA - A 53

Issued, January 30, 1943

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Standard Specifications for Welded and Seamless Steel Pipe (A 53 - 42) and affect only the requirements referred to:

Section 1. (a).—Add the following two sentences at the end of this paragraph:

When pipe is ordered under these specifications for use as water-well pipe, all requirements of these specifications as to chemical composition and physical properties shall apply, except in the case of grade C drive pipe for which grade no flattening tests shall be required. Hydrostatic tests for water-well pipe shall be made in accordance with the requirements prescribed in the accompanying Table II (a).

Table I.—Add the following requirements for a new grade C seamless or electric-resistance-welded pipe:

Seamless or Electric-Resistance-Welded	Grade C
Tensile strength, min., psi	65 000
Yield point, min., psi	40 000
Elongation, in 8 in., min., per cent	....
Elongation, in 2 in., min., per cent	....
Elongation in 2 in., min., per cent:	
Basic minimum elongation for wall $^5/_{16}$ in. and over in thickness, longitudinal strip tests, and for all small sizes tested in full section	18
When standard round 2-in. gage length test specimen is used	...
For longitudinal strip tests a deduction for each $^1/_{32}$-in. decrease in wall thickness below $^5/_{16}$ in. from the basic minimum elongation of the following percentage	1.50[c]

In footnote *c* to Table I add the following computed minimum elongation values for grade C:

Wall Thickness, in[a]	Elongation, min., per cent Grade C
$^5/_{16}$ (0.3125)	18.00
$^9/_{32}$ (0.281)	16.50
$^1/_4$ (0.250)	15.00

[a] These are the only wall thicknesses applicable to grade C.

Section 7. (a).—Change this paragraph to read as follows by the addition of the italicized words:

7. (*a*) The flattening test shall be made on standard weight and extra strong pipe over 2 in. in nominal diameter. It shall not be required for double extra strong *or grade C drive pipe.*

Section 8.—Change this section to read as follows by the addition of the italicized words:

8. Each length of pipe, *except drive pipe*, shall be tested at the mill to the hydrostatic pressures prescribed in Table II. *Drive pipe shall be tested at the mill to the hydrostatic pressures prescribed in Table II (a).* Welded pipe 2 in. and larger shall be jarred near one end while under test pressure.

Add a new Table II (*a*) to read as follows:

TABLE II (*a*).—HYDROSTATIC TEST PRESSURES FOR WELDED AND SEAMLESS STEEL DRIVE PIPE

(Pressures Expressed in Pounds per Square Inch)

Size (Nominal Inside Diameter), in.[a]	Wall Thickness, in.	Lap Welded and Grade A	Electric-Resistance Welded and Seamless Grade C
6	0.280	1200	2000
8	0.277	1200	1500
8	0.322	1200	1800
8	0.354	1200	2000
10	0.279	1000	1200
10	0.307	1000	1400
10	0.365	1000	1600
12	0.330	1000	1200
12	0.375	1000	1400
14	0.375	950	1300
15	0.375	900	1200
16	0.375	850	1100

[a] Drive Pipe is furnished only in the sizes listed in this table.

EA - A 235

Issued, January 30, 1943

The following Emergency Alternate Provisions, when specified, may be used as alternates for general purpose heavy forgings in A.S.T.M. Standard Specifications for Carbon-Steel Forgings for General Industrial Use (A 235 - 42) and affect only the requirements referred to:

Section 7.—In the table of requirements for chemical composition make the following addition:

Class A.......Add a requirement for carbon content of 0.08 to 0.18 per cent

Table I.—Make the following changes and additions:

Class A.......Omit the requirements for tensile strength and yield point.

Class E........Add the following requirements for forgings over 20 in. in solid diameter or thickness:

Tensile strength, min., psi	70 000
Yield point, min., psi	35 000
Elongation in 2 in. min., per cent	20
Reduction of area, min., per cent	30

EA - A 237

Issued, January 30, 1943

The following Emergency Alternate Provisions, when specified, may be used as alternates for general purpose heavy forgings in A.S.T.M. Standard Specifications for Alloy-Steel Forgings for General Industrial Use (A 237 - 42) and affect only the requirements referred to:

Table I.—Add the following requirements for class B forgings over 20 in. in solid diameter or thickness:

Tensile strength, min., psi	80 000
Yield point, min., psi	50 000
Elongation in 2 in., min., per cent	18
Reduction of area, min., per cent	28

Add a note to Table I to read as follows:

NOTE.—If nickel steels are not or cannot be used in these forgings (except class F), the values for percentage minimum elongation in 2 in. shall be reduced by 2, and the values for percentage minimum reduction of area shall be reduced by 4.

EA - B 8

Issued, December 11, 1942

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Standard Specifications for Concentric Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft (B 8 - 41), and affect only the requirements referred to:

Section 1 (a).—Change to read as follows by the addition of the italicized words:

1. (*a*) These specifications cover concentric-lay-stranded conductors made from round copper wires, either uncoated or coated with tin, *lead, or lead alloy*, for general use for electrical purposes.

Section 2 (b).—Add the following to the list of approved specifications for copper wire which may be used in the manufacture of these stranded copper conductors:

Emergency Specifications for Lead-Coated and Lead-Alloy Coated Copper Wire for Electrical Purposes (A.S.T.M. Designation: ES - 1a) the American Society for Testing Materials.

Section 6 (a).—Change the first sentence of this paragraph to read as follows by the addition of the italicized words:

6. (*a*) Tests for the physical and electrical properties of wires composing conductors made from annealed copper wire or from tinned, *lead-coated, or lead-alloy coated* soft copper wire may be made before stranding or on wires removed from the conductor.

Section 6 (b).—Change this paragraph to read as follows by the addition of the italicized words:

6. (*b*) If a tinning, *lead-coating, or lead-alloy coating* test is required, it shall be made on the wires prior to stranding.

EA – B 23a

(Standard Specifications for White Metal Bearing Alloys (Known Commercially as "Babbitt Metal") (B 23 – 26))

Issued, January 5, 1943
(Superseding Issue of April 6, 1942)

This Provision modifies a previous one by reducing the antimony range for Alloy Grade No. 15 from the previous figure of "14.75 to 15.5" to read "14.5 to 15.5"; the copper requirement reads "0.6 max." instead of the range "0.4 to 0.6"; and the arsenic is changed from the former figure "0.6 to 1.1" to read "0.8 to 1.1." There have been no other changes in the chemical or physical properties of the six alloy grades covered in the Emergency Alternate Provision.

EA – B 32a

Issued, January 5, 1943
(Superseding Issue of April 6, 1942)

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Tentative Specifications for Soft Solder Metal (B 32 – 40 T) and affect only the requirements referred to:

Section 3.—Due to the fact that the Government has forbidden the use of solders containing more than 30 per cent tin (except by special permission of appropriate Government board) typical tin-lead alloy compositions follow:

For the Emergency, grade A tin-lead solders and grade A tin-lead-antimony solders are to be abolished. The nominal content of tin and

Tin, per cent	Lead, per cent
30	70
25	75
20	80
15	85
10	90
5	95

lead or of tin, lead, and antimony shall be specified in the purchase order.

In addition to the above tin-lead alloys, the following alloys are suggested as substitute solders:

Alloy[b]	Tin,[a] per cent	Lead, per cent	Bismuth,[a] per cent	Silver,[a] per cent	Antimony, max., per cent	Copper, max., per cent
11	20	Remainder	0 to 0.75	1.25	0.5	0.08
12	20	Remainder	5	1.25	0.5	0.08
13	15	Remainder	0 to 0.75	1.25	0.5	0.08
14	15	Remainder	5	1.25	0.5	0.08
15	10	Remainder	0 to 0.75	1.50	0.5	0.08
16	None	Remainder	None	2.50	0.5	0.08
17	0.65 to 0.85	Remainder	None	0.25	0.5	0.08

[a] The permissible variations in these elements shall be as follows: Tin: nominal minus 0.50, except in the case of alloys 16 and 17; Bismuth: plus or minus 0.25 in alloys 12 and 14, and 0.25 maximum in alloys 16 and 17; Silver: plus or minus 0.10.
[b] Alloys 11, 12, 13, 14, 15, and 16 are in conformity with the S.A.E. Emergency Solders Nos. E01, E02, E03, E04, E05, and E07, respectively.

The above listed typical tin-lead alloy compositions and the seven alternate alloys are hand and dipping solders and cannot be used for wiping.

These are typical industrial alloys which are procurable. The table is not all inclusive and as new developments are made, these emergency alternate provisions will be revised.

Appendix.—Add the following data as information to the table of properties of soft solder metal which appears in the Appendix of Specifications B 32 – 40 T; the figures for the first eight alloys replacing the data for the corresponding alloys now appearing in the Appendix:

Information on Uses and Applications

Alloy 11.—This alloy is suitable for all general commercial work. It works well at high speeds, does not crack in flanging operations, produces pressure-tight seams, and is a very clean metal to handle. All in all, it is an excellent solder.

Alloy 12.—This mixture is designed for work where a low melting point is a necessity, such as in the hand-soldering, so as to prevent scorching or buckling. This alloy has a tendency to crack if there is a strain on the joint when cooling.

Alloy 13.—Alloy 13 is a good all-around solder for commercial work. It works well on tin plate, galvanized sheet, black or terne plate, and thin copper. Its use requires a hot iron.

Alloy 15.—Alloy 15 is designed for use where a high melting point is not detrimental and where high strength and good spread are not important, as in the coating of wire, and dipping motor terminals.

The lead-silver solders appear to have the best creep strength of the lead-base solders and are available for use where high melting point and moderate spreading qualities are not objectionable.

PROPERTIES OF SOFT SOLDER METAL.

Nominal Composition, per cent					Melting Range			
					Solidus		Liquidus	
Tin	Antimony	Lead	Bismuth	Silver	deg. Fahr.	deg. Cent.	deg. Fahr.	deg. Cent
30	0 to 0.4	Remainder	...	...	361	183	494	257
28	1.5 to 2.0	Remainder	...	...	361	183	484	251
25	0 to 0.4	Remainder	...	...	361	183	511	266
25	1.25 to 1.75	Remainder	...	...	361	183	502	261
20	0 to 0.4	Remainder	...	...	361	183	525	274
20	1.25 to 1.75	Remainder	...	...	361	183	518	270
15	0 to 0.4	Remainder	...	...	361	183	543	284
15	0.4 to 2.75	Remainder	...	...	361	183	532 to 541	278 to 283
20	0 to 0.5	Remainder	0 to 0.75	1.25	356	180	518	270
20	0 to 0.5	Remainder	5	1.25	333	167	486	252
15	0 to 0.5	Remainder	0 to 0.75	1.25	358	181	532	278
15	0 to 0.5	Remainder	5	1.25	333	167	503	262
10	0 to 0.5	Remainder	0 to 0.75	1.50	352	178	554	290
...	0 to 0.5	Remainder	...	2.50	579	304	579	304
0.65 to 0.85	0 to 0.5	Remainder	...	0.25	579	304	608	320

EA – B 12, EA – B 19, EA – B 22, EA – B 36, EA – B 100, EA – B 103, EA – B 111, EA – B 121, EA – B 122, EA – B 124, EA – B 129, EA – B 130, EA – B 131, EA – B 134, EA – B 135, EA – B 139, EA – B 151, EA – B 159, EA – B 169, EA – B 171

Issued, December 14, 1942

The following Emergency Alternate Provisions, when specified, may be used as an alternate in the following specifications and affect only the requirements referred to:

Copper Bars for Locomotive Staybolts (B 12 – 42)
Cartridge Brass Sheet, Strip, and Disk (B 19 – 42 T)
Bronze Castings for Turntables and Movable Bridges and for Bearing and Expansion Plates of Fixed Bridges (B 22 – 40 T)
Brass Sheet and Strip (B 36 – 41 T)
Rolled Copper-Alloy Bearing and Expansion Plates for Bridge and Other Structural Uses (B 100 – 40)
Phosphor Bronze Sheet and Strip (B 103 – 42)
Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock (B 111 – 42)
Leaded Brass Sheet and Strip (B 121 – 41)
Copper-Nickel-Zinc and Copper-Nickel Alloy Sheet and Strip (B 122 – 39 T)
Copper-Base Alloy Forging Rods, Bars, and Shapes (B 124 – 42 T)
Cartridge Brass Cartridge Case Cups (B 129 – 40 T)
Gilding Metal Sheet and Strip (B 130 – 41 T)
Gilding Metal Bullet Jacket Cups (B 131 – 40 T)
Brass Wire (B 134 – 42 T)
Miscellaneous Brass Tubes (B 135 – 42 T)
Phosphor Bronze Rods, Bars, and Shapes (B 139 – 42 T)
Aluminum Bronze Sand Castings (B 148 – 42 T)
Copper-Nickel-Zinc Alloy Rod and Wire (B 151 – 42 T)
Phosphor Bronze Wire (B 159 – 42 T)
Aluminum Bronze Sheet and Strip (B 169 – 41 T)
Copper-Alloy Condenser Tube Plates (B 171 – 42 T)

Respective Section Nos.—Add a reference to the following specifications as covering an alternate grade of copper approved for use in the manufacture of . . . . (specific product covered inserted here):

Emergency Specifications for Fire-Refined Copper for Wrought Products and Alloys (A.S.T.M. Designation: ES – 7) of the American Society for Testing Materials.

EA – B 133, EA – B 152

Issued, December 14, 1942

The following Emergency Alternate Provisions, when specified, may be used as an alternate in the following specifications and affect only the requirements referred to:

Copper Rods, Bars, and Shapes (B 133 – 42 T)
Copper Sheet, Strip, and Plate (B 152 – 41 T)

Section 3.—Add a reference to the following specifications as covering an alternate grade of copper approved for use in the manufacture of . . . . (specific product covered inserted here); except when the material is to be used for electrical purposes:

Emergency Specifications for Fire-Refined Copper for Wrought Products and Alloys (A.S.T.M. Designation: ES – 7) of the American Society for Testing Materials.

EA – D 69

Issued, November 25, 1942

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Standard Specifications for Friction Tape for General Use for Electrical Purposes (D 69 – 38), and affect only the requirements referred to:

Section 3.—Add the following requirements at the end of this section on frictioning compound:

The finished tape shall contain not more than 30 lb. of rubber hydrocarbon per 100 sq. yd. No new rubber shall be used in the manufacture of this tape.

Section 6.—Change this section to read as follows:

6. The tape shall show tackiness, that is, ability to stick to itself after light contact has been made, when tested front to front in accordance with the procedure described in Section 21.

Section 7.—Omit this section which prescribes the requirement for discoloration of copper.

Section 13.—Change the permissible variations in thickness from "plus or minus 0.002 in." to read "plus or minus 0.003 in."

Section 17.—Change the heading of this section to read "Storage" and omit the last sentence covering guarantees.

Section 19 (a).—Change the requirements for dividing into lots for sampling the number of rolls offered for inspection to read as follows:

Rolls Offered for Inspection	Number of Lots
500 and under	1
501 to 1500	2
1501 to 3000	3
Over 3000	3 plus 1 for each additional 1500 rolls

Section 20.—In the first sentence of Paragraph (*a*) change the length of specimen required for the adhesion test from "23 in." to read "30 in."
In the third sentence of Paragraph (*a*) change the length of tape required to be wound around the mandrel from "19 in." to read "25 in."
In the sixth sentence of Paragraph (*a*) change the maximum length that may unwind in the first 1-min. interval from "15 in." to read "25 in."
Omit Paragraph (*b*) which describes the oven test for tape.

Section 21.—In place of the fifth and sixth sentences of Paragraph (*a*) which reads as follows:

Tackiness in at least two of the combinations (*1*), (*2*), and (*3*) specified in Section 6 shall be such that the point of separation remains approximately in the same horizontal plane as the hands that pull the tape apart. In the back to back combination the specimens shall show some indication of tackiness by the point of separation traveling along the tapes as the hands pull the tape apart.

substitute the following:

The tackiness specified in Section 6 shall be such that the point of separation remains approximately in the same horizontal plane as the hands that pull the tape apart.

Change Paragraph (*b*) to read as follows:

(*b*) The tackiness shall be determined three times and if more than one test fails to conform to the requirements specified in Section 6, the tape shall be considered as not conforming to the tackiness requirement.

Section 22.—Omit this section which describes the test for discoloration of copper.

EA – D 119

Issued, November 25, 1942

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Standard Specifications for Rubber Insulating Tape (D 119 – 38), and affect only the requirements referred to:

Section 2.—Omit from this section the last sentence which reads as follows:

Preferably, the tape shall be dark gray in color.

Section 4.—Change the requirements for the composition of the rubber compound to read as follows:

4. The rubber compound shall contain not more than 7 lb. of new rubber and not more than 21 lb. of reclaimed rubber per 27,000 sq. in. of tape 0.027 in. in thickness.

Section 5.—Change the requirements for tensile strength and elongation to read as follows:

5. (*a*) The tensile strength of the tape shall be not less than 200 psi.

(*b*) The elongation of a 2-in. gage length determined simultaneously with the tensile strength shall be not less than 250 per cent.

Section 6.—Change the requirement for dielectric strength to read as follows:

6. The dielectric strength of the tape shall be not less than 300 v. per mil of thickness.

Section 8.—For all three widths of tape change the requirements for thickness from "0.030 in." to read "0.027 in."

Section 13.—Change the heading of this section to read "Storage" and omit the last sentence covering guarantees.

Section 15 (a).—Change the requirements for dividing into lots for sampling the number of rolls offered for inspection to read as follows:

Rolls Offered for Inspection	Number of Lots
500 and under	1
501 to 1500	2
1501 to 3000	3
Over 3000	3 plus 1 for each additional 1500 rolls

Section 16.—Omit this section covering the procedure for chemical analysis of the rubber compound.

EA - D 469a
(Standard Specifications for Insulated Wire and Cable: Heat-Resisting Rubber Compound (D 469 - 41))

Issued, January 15, 1943
(Superseding Issue of April 6, 1942)

This Emergency Alternate Provision modifies a previous Emergency Provision by the following additional changes:

Section 2.—Omit the last clause which reads as follows:

"including the use of a temperature of 80 C. in the oxygen pressure chamber aging test."

Table I.—Replace the present Table I with a new Table I reading as follows:

TABLE I.—PHYSICAL TEST REQUIREMENTS FOR INSULATION

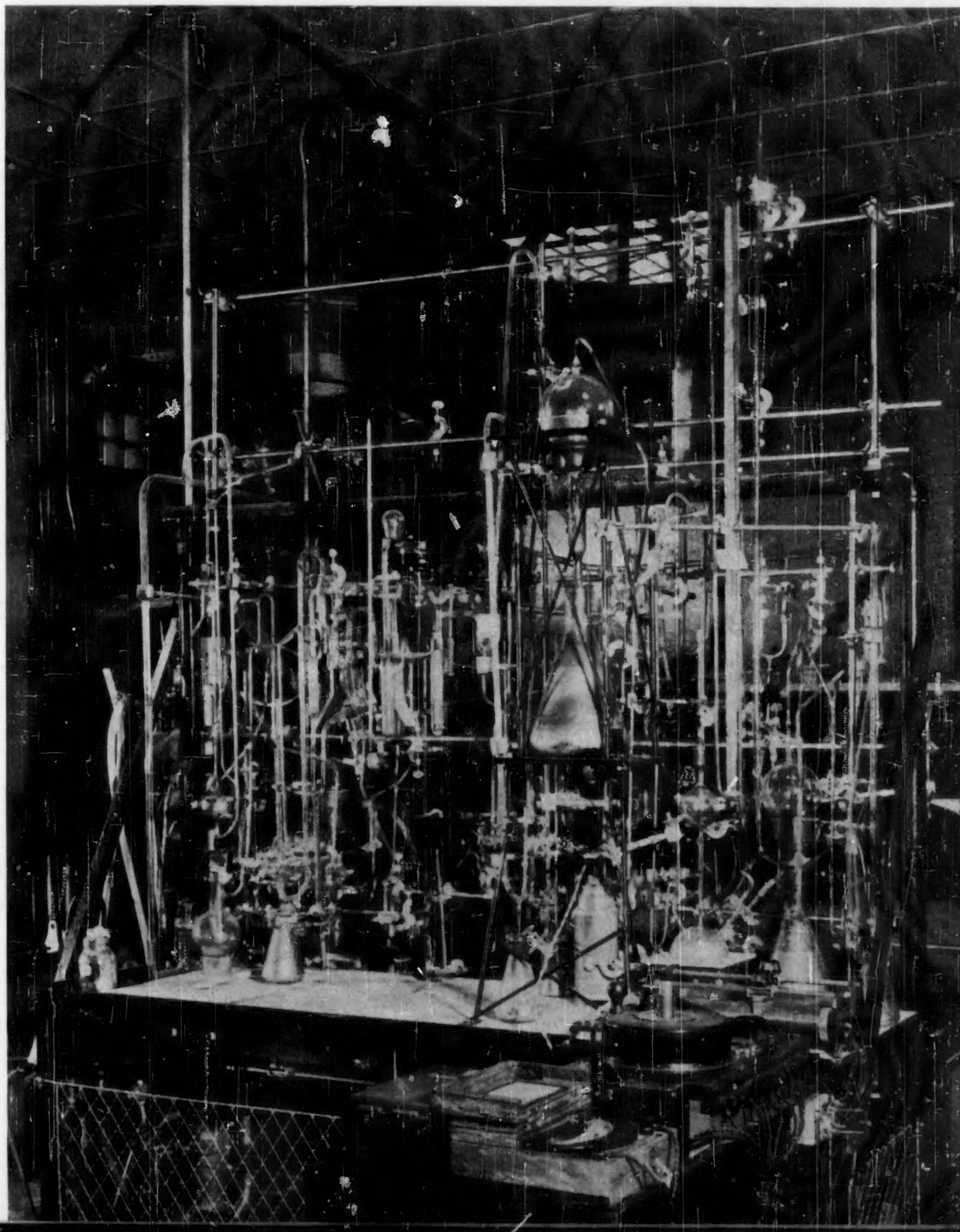
Tensile strength, min., psi.	850
Elongation at rupture, min., per cent	300
Set in 2-in. gage length, max., in.	0.5
Loss in tensile strength and elongation after 20 hr. in air pressure heat test, max., per cent	50

Table III.—Decrease the tabulated values for insulation resistance by one-third.

In the Note to Table III change the value of the constant K from "15,840" to read "10,560."

Report on Stresses in Concrete Pavements

Materials engineers and designers concerned with concrete pavements will be interested in a report recently issued by Iowa State College, Ames, Iowa, giving the results of extensive investigations dealing with Stresses in the Corner Region of Concrete Pavements as carried out and reported by Prof. M. G. Spangler. The report points out that over four thousand corners might be built into a mile of two-lane concrete pavement with a single longitudinal joint and transverse joints spaced 10 ft. apart, so a knowledge of the stress concentration and action in pavement corners is most important. The report covers results of both laboratory stress measurements and actual field measurements. Single copies of the 96-page Bulletin can be obtained without charge from the Iowa Engineering Experiment Station.



Some determinations require elaborate apparatus or glassware setups as the accompanying illustration shows. This was used by Messrs. Shadduck and Van Zee in their paper "Analysis of Gases in Glass and in Seeds", March 1942 issue, *Journal of The American Ceramic Society* through whose courtesy the illustration is shown.

NEW MEMBERS TO JANUARY 14, 1943

The following 80 members were elected from December 4, 1942 to January 14, 1943:

Chicago District

DEARBORN CHEMICAL CO., A. H. Reynolds, Chief Chemist, 310 S. Michigan Ave., Chicago, Ill.

INSTITUTE OF GAS TECHNOLOGY, J. F. Smith, Technical Librarian, 3300 Federal St., Chicago, Ill.

MILWAUKEE PUBLIC LIBRARY, 814 W. Wisconsin Ave., Milwaukee, Wis.

STICKNEY, FLOYD S., Chief Inspector, Carnegie-Illinois Steel Corp., Gary Steel Works, Gary, Ind. For mail: Hotel Gary, Gary, Ind.

Cleveland District

HYCAR CHEMICAL CO., W. D. Parrish, Technical Service Manager, Peoples Bank Building, Akron, Ohio.

LINCOLN ELECTRIC CO., THE, James F. Lincoln, Jr., Application Engineer, 12818 Coit Road, Cleveland, Ohio.

WARNER & SWASEY CO., THE, William J. Burger, Director of Engineering, 5701 Carnegie Ave., Cleveland, Ohio.

CHURCHILL, HARRY D., Associate Professor of Mechanics, Case School of Applied Science, 10900 Euclid Ave., Cleveland, Ohio.

FULLER, JOHN L., Experimental Engineer, Reliance Electric and Engineering Co., 1088 Ivanhoe Road, Cleveland, Ohio.

HORAN, J. WILLIAM, Foundry Superintendent and Metallurgist, Sandusky Foundry and Machine Co., Sandusky, Ohio.

MARKS, MAURICE E., Research Chemist and Supervisor of Organic Research Testing Laboratory, Columbia Chemical Division, Pittsburgh Plate Glass Co., Research Laboratory, Barberton, Ohio.

SEBESTA, WILLIAM EDWARD, Metallurgical Observer, Carnegie-Illinois Steel Corp., Youngstown, Ohio. For mail: 5407 Fleet Ave., Cleveland, Ohio. [J]*

WILLIAMS, DAVID M., Manager, Physical Testing Dept., The Arco Co., 7301 Bessemer Ave., Cleveland, Ohio.

Detroit District

LIQUID COOLED ENGINE DIVISION, THE AVIATION CORP., J. H. LaRose, Chief Metallurgist, Laskey Road, Toledo, Ohio. [S]†

SOCONY-VACUUM OIL CO., INC., FLAT ROCK WORKS, N. H. Seymour, Chief Chemist, Box 746, Trenton, Mich.

BROWN, WARREN G., Director of Research, Western Waterproofing Co., 155 W. Congress St., Detroit, Mich.

TOPPING, C. E., Metallurgist, Hayes Industries, Inc., Jackson, Mich.

New York District

GENERAL BRONZE CORP., P. J. Keulemans, Assistant to President, 34-19 Tenth St., Long Island City, N. Y.

REPUBLIC AVIATION CORP., G. W. CORRIE, Director of Inspection Laboratory, Conklin St., Farmingdale, N. Y.

BARTSCH, C. E., Chemist, E. I. du Pont de Nemours and Co., Inc., Parlin, N. J. For mail: R.F.D. 5, Box 365, New Brunswick, N. J.

BEICHERT, WALTER J., Chemist, Lindsay Laboratories, 302 Ashland Place, Brooklyn, N.Y.

BOLTON, F. ERNEST, Head, Color Sales Service Laboratory, E. I. du Pont de Nemours and Co., Inc., 256 Vanderpool St., Newark, N. J.

BRAZILIAN GOVERNMENT AIRPLANE ENGINE FACTORY COMMISSION, Heraldo de Souza Mattos, Chief, Room 1355, 60 E. Forty-second St., New York, N. Y.

CHANG, CHIEH CHIEN, Engineer in Charge, United States Plywood Corp., Plant No. 2, New Rochelle, N. Y. For mail: Y.M.C.A., New Rochelle, N. Y.

EILENBERG, T. R., Assistant Structural Engineer, Consolidated Edison Co. of New York, Inc., 4 Irving Place, New York, N. Y.

GRUMBLY, W. T., Test Engineer, Consolidated Edison Co. of New York, Inc., 4 Irving Place, New York, N. Y.

HOLTBERG, EDWIN P., Winchester Repeating Arms Co., Division of Western Cartridge Co., Box 906, New Haven, Conn.

LATHROP, HUBBEL, Commercial Products Supervisor, Western Electric Co., Inc., 395 Hudson St., New York, N. Y.

MANLEY, ROBERT WILLIAM, Junior Test Engineer, Sperry Gyroscope Co., Brooklyn, N. Y. For mail: 92-32 Fifty-second Ave., Elmhurst, Queens, N. Y. [J]

POMEROY, LENDAL W., Chemical Engineer, Johns-Manville Corp., Manville, N. J. For mail: 24 Johnson Ave., Newark, N. J.

PORT, JOEL E., Chemical Engineer, Signal Corps, U. S. War Dept., Radar Laboratories, Belmar, N. J. For mail: 1423 Forty-second St., Brooklyn, N. Y. [J]

SAMPLE, CLARENCE H., Member of Technical Staff, Bell Telephone Laboratories, Inc., 463 West St., New York, N. Y.

SOMERS, JOHN C., Manager of Engineering and Sales, F. E. Schundler and Co., Inc., 45-15 Vernon Boulevard, Long Island City, N. Y.

Northern California District

CLEVELAND, THEODORE K., Chief Chemist, Philadelphia Quartz Co. of California, Ltd., Sixth and Grayson Sts., Berkeley, Calif.

Philadelphia District

CALBAR PAINT AND VARNISH CO., M. Hibner, Technical Director, 2620 N. Martha St., Philadelphia, Pa.

BOYD, THOMAS F., Associate Chemist, U. S. Navy Yard, Philadelphia, Pa. For mail: 3334 Lancaster Ave., Philadelphia, Pa.

ROYSTUART, VICTOR I., Consulting Engineer, Juniper St. and Sunnemead Ave., Warminister, Pa.

WAMSLEY, DELOS H., Supervisor, Chemistry Laboratory, R.C.A. Manufacturing Co., Inc., Lancaster, Pa.

ZIMMERMAN, J. MILTON, Vice-President and Manager, Master Lubricants Co., Meadow and Jackson Sts., Philadelphia, Pa.

Pittsburgh District

BOYD, JOHN ROBERT, Trainee, Westinghouse Electric and Manufacturing Co., Research Laboratories, East Pittsburgh, Pa. For mail: 563 Princeton Boulevard, Wilkinsburg, Pa. [J]

SHERMAN, JEROME, Junior Shop Engineer, Bacharach Industrial Instrument Co., Pittsburgh, Pa. For mail: 717 N. Murtland St., Pittsburgh, Pa. [J]

WAGNER, ERNEST J., President, Standard Steel Specialty Co., Beaver Falls, Pa.

St. Louis District

ROBERTS, S. B., District Manager, Robert W. Hunt Co., 1403 Syndicate Trust Building, St. Louis, Mo.

Southern California District

MASTER LUBRICANTS CO., William L. Hagenbaugh, President, 962 E. Fourth St., Los Angeles, Calif.

HEYSER, D. L., Physical Test Engineer, Ryan Aeronautical Co., San Diego, Calif. For mail: Box 173, Lemon Grove, Calif. [J]

HOLMES, JAMES T., Partner, Holmes & Narver, 639 S. Spring St., Los Angeles, Calif.

ROSS, FRANK J., Chief Research Chemist, Adel Precision Products Corp., Burbank, Calif. For mail: 113 E. Olive Ave., Burbank, Calif.

U. S. and Possessions

Other than A.S.T.M. Districts

BAY STATE ABRASIVE PRODUCTS CO., William R. Morgan, Director of Research, Westboro, Mass.

BEACH SOAP CO., L. T. Howells, General Manager, 125 Lawrence St., Lawrence, Mass.

CHARLTON LABORATORIES, David B. Charlton, Owner-Manager, 2340 S. W. Jefferson St., Portland, Ore.

DICKSON GUN PLANT, HUGHES TOOL CO., Operators, Gorham W. Woods, Process Engineer, 9640 Clinton Drive, Houston, Tex.

Lasting Products Co., L. Pritzker, Technical Director, 202 S. Franklintown Road, Baltimore, Md.

Remington Rand, Inc., Propeller Division, Michael G. Corson, Chief Metallurgist, 600 Main St., Johnson City, N. Y.

Richmond Engineering Co., Inc., Paul Hickman, Chief Engineer, Seventh and Hospital Sts., Richmond, Va.

Sowers Manufacturing Co., D. W. Sowers, President, 1288 Niagara St., Buffalo, N. Y.

Andrews, Andrew I., Professor of Ceramic Engineering and Head, Department of Ceramic Engineering, University of Illinois, 204 Ceramics Building, Urbana, Ill.

Blaine, Raymond L., Assistant Materials Engineer, National Bureau of Standards, Washington, D. C.

Cornell University Library, Ithaca, N. Y.

Hayner, J. Halmer, Senior Materials Engineer, Specifications Branch, Conservation Division, War Production Board, Washington, D.C. For mail: 1820 Clydesdale Place, N. W., Washington, D. C.

King, Harold R., Metallurgist, Metal and Alloy Specialties Co., Inc., Buffalo, N. Y. For mail: 1306 Delaware Ave., Buffalo, N. Y.

Kuhns, Robert W., President, Kuhns Bros. Co., 1800 McCall, St., Dayton, Ohio.

McCray, H. E., Chief Engineer, Cabot Shops, Inc., Box 1101, Pampa, Tex.

Phillips, Adelbert G., Engineer, Gannett, Eastman & Fleming, Engineers, Upper Marlboro, Md. For mail: 205 Pine Grove Drive, Morningside, Md., P. O. Anacostia, D. C.

Psyck, Irving A., Metallurgist, Easy Washing Machine Corp., Solar and Spencer Sts., Syracuse, N. Y.

Saleh, G. E. R., Chief Metallurgist, Easy Washing Machine Corp., Solar and Spencer Sts., Syracuse, N. Y.

Shepard, Hugh Martin, Manager, American Smelting and Refining Co., Highland and Eastbourne Aves., Baltimore, Md.

Tippy, Kenneth C., Assistant Professor of Civil Engineering, Department of Civil Engineering, Syracuse University, Syracuse, N. Y.

Ver Bryck, L. A., Washington Sales Representative, Pittsburgh Steel Co., Normandy Building, 1624 K St., N. W., Washington, D. C.

Weinberg, Edwin A., Engineer, The Ludlow Valve Manufacturing Co., Inc., Troy, N. Y.

Weinland, Louis Albert, Director of Research, Simonds Worden White Co., Summit St. at Negley Place, Dayton, Ohio.

Wendt, Kurt F., Associate Professor of Mechanics, University of Wisconsin, Madison, Wis. For mail: 922 Waban Hill, Madison, Wis.

Williams, Samuel W., Jr., Engineer, Turner Construction Co., Boston, Mass. For mail: Highwood Ave., Southington, Conn. [J]

Other than U. S. and Its Possessions

Barbosa, Mamede Manetti, Chemist, Condoroil Tintas S. A., Rio de Janeiro, Brazil. For mail: Caixa Postal, 2454 Rio de Janeiro, Brazil.

Keightley, W. A., London Representative, Universal Oil Products Co., 18 Dorset House, Gloucester Place, London, N. W. 1, England.

McCulloch, Orval J., Consulting Civil Engineer, Keefer Building, Montreal, P. Q., Canada.

McGrath, Paul R., Inspecting Officer, Inspection Board of United Kingdom and Canada, Ottawa, Ont., Canada. For mail: Box 860, Sorel, P. Q., Canada.

Mexico Escuela Superior de Ingenieria y Arquitectura, Prolongacion de Lauro Aguirre, Sto. Tomas, D. F., Mexico.

Queen's University, Department of Civil Engineering, S. D. Lash, Assistant Professor, Kingston, Ont., Canada.

Universidad de Litoral, Facultad de Ciencias Matematicas, (Instituto de Estabilidad), Augusto J. Durelli, Director of Institute, Avenida Pellegrini 250, Rosario, Argentina.

Wyman, H. R., Consulting Chemist, 19 Kaye St., Halifax, Nova Scotia.

* [J]—Denotes Junior Member.

† [S]—Denotes Sustaining Member. See article on Sustaining Members, p. 42.

PERSONALS

• • • News items concerning the activities of our members will be welcomed for inclusion in this column.

R. L. Coryell, formerly Assistant Engineer, Consolidated Edison Co. of New York, Inc., New York, N. Y., is now a Major in the U. S. Army.

Lyman Billings, who was Process Products Representative, Socony-Vacuum Oil Co., Inc., Cambridge, Mass., is now First Lieutenant, with address at Officers Replacement Pool, Edgewood Arsenal, Md.

J. L. Schmeller, formerly Executive Vice-President, The National Bronze and Aluminum Foundry Co., Cleveland, Ohio, is now President of the company.

J. C. Sprague has a leave of absence from the Dravo Corp., Pittsburgh, Pa., to serve in construction forces of the U. S. Army, building the U. S. Army Bomber Plant, at Marietta, Ga. His address is U. S. Engineers Office, Atlanta District, Marietta, Ga.

E. J. McMahon, who was Marine Boiler Design Engineer, Combustion Engineering Co., Inc., New York, N. Y., has entered the Army.

P. V. McKinney, who was Director of Research, The Neville Co., Neville Island, Pittsburgh, Pa., is now Research Chemist, Thiokol Corp., Trenton, N. J.

L. W. Teller is now Principal Engineer of Tests, U. S. Public Roads Administration, Washington, D. C. He was Senior Engineer of Tests.

I. H. Boggs, who was General Superintendent, Bituminous Concrete Division, General Crushed Stone Co., Easton, Pa., is now Vice-President, Delaware Testing Laboratories, Inc., Dover, Del.

E. B. Rubloff, formerly Consulting Chemist, Ohio Valley Testing Laboratory, Bellaire, Ohio, is now Principal Chemist, Basic Magnesium, Inc., Las Vegas, Nev.

J. D. Tyson is now Manager of Sales and Metallurgy, Standard Steel Works Division, The Baldwin Locomotive Works, Burnham, Pa. He was formerly Chief Metallurgist for this company.

L. P. Schmitt, Sales Engineer, The Joslyn Co., New York, N. Y., is now in military service.

M. E. McConnell, Architect, Highland Park, Mich., has been in active military service of the United States as an officer in the Coast Artillery Corps (AA) on duty overseas since last April.

E. C. Miller, formerly Oil Technician, West Penn Oil Co., Warren, Pa., is temporarily relinquishing his A.S.T.M. work since he has left for Foreign Service with the American Red Cross.

J. K. Beeson, who has been Vice-President, In Charge of Sales, Pittsburgh Steel Co., Pittsburgh, Pa., has been in the Army Air Corps for a number of months.

D. C. Scott, Jr., of the Henry L. Scott Co., Inc., Providence, R. I., is now a Lieutenant (jg) in the Navy and is stationed at Washington in the Bureau of Ships.

J. P. Dyer was recently elected a Director of the Phelps Dodge Refining Corp., New York, N. Y. He has been with the company since 1929, and in his present position, Vice-President, since 1936.

At the next annual meeting of the Iron and Steel Division, American Institute of Mining and Metallurgical Engineers, M. A. Grossmann, Director of Research, Carnegie-Illinois Steel Corp., Chicago, Ill., will be presented with the Robert W. Hunt Gold Medal for his work on hardenability, as summarized in his now well-known paper "Hardenability Calculated from Chemical Composition" presented at the last annual meeting. At the annual dinner of the Institute of Metals Division the annual award of the non-ferrous group will be presented to J. D. Hanawalt, Director of Metallurgical Laboratory, The Dow Chemical Co., Midland, Mich., together with C. E. Nelson and J. A. Peloubet, for their significant contribution to knowledge of corrosion of magnesium and its alloys, as summarized in their paper given in Philadelphia in October, 1941. Selected as lecturers for the Metals Divisions, for the Annual Meeting in February, 1944, are: J. T. MacKenzie, Chief Metallurgist, American Cast Iron Pipe Co., Birmingham, Ala., who will give the Howe Memorial Lecture, and W. M. Peirce,

Chief, Research Division, The New Jersey Zinc Co., Palmerton, Pa., will deliver the annual Institute of Metals Division lecture.

E. R. YOUNG, Metallurgical Engineer, Climax Molybdenum Co., Chicago, Ill., is serving as chairman of a War Problems Committee organized by the Chicago Chapter of the American Foundrymen's Association. This committee is to assist members and foundrymen of the area generally on all problems of a technical or general nature relating to the production of castings, excluding wage-hour matters and labor relations. G. H. STARMAN, Vice-President, Apex Smelting Co., Chicago, Ill., is serving as a member of this committee.

J. A. SCOTT, formerly with General Electric Co., Schenectady, N. Y., is now located at Aberdeen Proving Grounds, Md.

A. F. WALTZ, President, Advance Pressure Castings, Inc., Brooklyn, N. Y., has been elected president of the American Die Casting Institute, Inc.

H. J. ROSE, formerly Senior Industrial Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa., has been appointed Vice-President in charge of Research, Anthracite Industries, Inc., Primos, Pa.

F. R. SCHERER, Superintendent of School Buildings, Board of Education, Rochester, N. Y., is serving as Lieutenant Colonel in the armed forces.

The following A.S.T.M. members have been nominated for office in the American Concrete Institute: M. O. WITHEY, Professor of Mechanics, University of Wisconsin, Madison, Wis., *President;* R. W. CRUM, Director, Highway Research Board, Washington, D. C., and D. E. PARSONS, Chief, Masonry Construction Section, National Bureau of Standards, Washington, D. C., *Vice-Presidents;* A. B. COHEN, Consulting Engineer, New York, N. Y., *Regional Director, Second District;* FRED HUBBARD, Consulting Engineer, The Standard Slag Co., Youngstown, Ohio, *Regional Director, Third District;* P. J. FREEMAN, Principal Materials Engineer, Tennessee Valley Authority, Knoxville, Tenn., *Regional Director, Fourth District;* T. E. STANTON, Materials and Research Engineer, California Division of Highways, Sacramento, Calif., *Regional Director, Sixth District;* STANTON WALKER, Director of Engineering, National Sand and Gravel Association, Washington, D. C., *Director-at-Large.*

Several A.S.T.M. members or committee members have been elected to office for the year 1943 for the Pittsburgh Section of the American Chemical Society, as follows: W. A. GRUSE, Senior Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa., *Chairman;* F. W. ADAMS, Senior Industrial Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa.; J. D. EDWARDS, Associate Director of Research, Aluminum Co. of America, New Kensington, Pa.; and H. V. CHURCHILL, Research Laboratories, Aluminum Co. of America, New Kensington, Pa., as *Councilors.*

H. W. GILLETT, Chief Technical Adviser, Battelle Memorial Institute, Columbus, Ohio, has relinquished his editorial directorship of the magazine *Metals and Alloys* in which capacity he has served for many years. It is indicated that pressure of other duties forces this step. To a large number of A.S.T.M. members Doctor Gillett's editorials have been most interesting. He has a forthright and unique method of expression which is apparent to those who have read any of the numerous technical papers and reports he has prepared for A.S.T.M. publications. The December issue of *Metals and Alloys* included a very appropriate closing statement from him and a tribute from the editorial staff of the magazine.

At the recent annual meeting of the Society of Automotive Engineers two A.S.T.M. members were elected to the S.A.E. Council for 1943–1944: C. G. A. ROSEN, Director of Research, Caterpillar Tractor Co., Peoria, Ill.; and J. C. ZEDER, Chief Engineer, Engineering Division, Chrysler Corp., Detroit, Mich.

Two A.S.T.M. members have been elected as Councilors of the Chicago Section, American Chemical Society, for 1943, as follows: B. E. SCHAAR, President, Schaar & Co., Chicago, Ill. and PAUL VAN CLEEF, Chemist, Van Cleef Brothers, Chicago, Ill.

Acid Open-Hearth Research

ANNOUNCEMENT was received some time ago of the organization of an Acid Open-Hearth Research Association formed by a number of companies, many active in A.S.T.M., for the purpose of conducting practical and technical research upon the problems governing the production of steel in the acid open-hearth steel furnaces.

Dr. G. R. Fitterer, Department of Metallurgy, University of Pittsburgh, has been appointed Director of Research, and J. W. Linhart, Research Metallurgist. The work will be conducted by Doctor Fitterer under the auspices of the University of Pittsburgh in conjunction with full study of actual furnace heats in the plants of the member companies.

Among the A.S.T.M. members who are actively participating in this work are F. H. Allison, Metallurgist, United Engineering and Foundry Co.; F. C. T. Daniels, Vice-President, Mackintosh Hemphill Co.; and R. C. Heaslett, General Metallurgist, Duquesne Division, Continental Roll & Steel Foundry Co. The notice received indicated that the group invited the participation of every acid open-hearth operating company.

NECROLOGY

We announce with regret the death of the following members:

J. E. GREINER, President, The J. E. Greiner Co., Baltimore, Md. Member since 1902.

DAVID W. HAERING, President and Technical Director, D. W. Haering and Co., Inc., Chicago, Ill. Member since 1941. Mr. Haering was a member of Committee D-19 on Water for Industrial Uses.

EDWARD G. LUNN, Chief, Research Laboratory, Bureau of Engraving and Printing, Washington, D. C. Member since 1938.

JOHN A. JOHNSON, Mechanical and Electrical Engineer, Chicago Bridge and Iron Co., Chicago, Ill. Member since 1942.

ALBERT KAHN, Albert Kahn, Inc., Detroit, Mich.

EDWARD MORTON, JR., Secretary, Philadelphia Steel and Iron Co., Conshohocken, Pa.

GEORGE BURR UPTON, Professor of Automotive Engineering, Cornell University, Sibley College, Ithaca, N. Y. Member since 1914.

H. H. VAUGHAN, Consulting Engineer, Montreal, P. Q., Canada. Member since 1915.

ROBERT LINTON, Consulting Mining and Industrial Engineer, Los Angeles, Calif. Member since 1915. At the time of his death Mr. Linton was a member of Committee C-4 on Clay Pipe which connection he held since 1931, being at one time the representative of the Clay Products Institute of California. He also held membership on Committee C-8 on Refractories from 1933 to 1937.

John Disario, 1894-1943

IN THE DEATH on January 17 of John Disario, Works Metallurgist, Columbia Steel Co., Torrance, Calif., the Society loses an active member, a most loyal supporter of the Society in the Southern California District centering in Los Angeles, and who had since 1937 served as chairman of the Southern California District Committee. During his chairmanship, a number of activities had been undertaken to promote interest in the Society in the southern west coast area. His death came suddenly. A native of Italy, he had been a long-time citizen of the United States. He was general chairman of the committee arranging the 1938 Western Metal Congress, and had been chairman of the Southern California Chapter of the American Society for Metals. Mr. Disario studied chemical engineering at Carnegie Institute of Technology, and metallurgy at the Case School in Cleveland. He is survived by Mrs. Disario, three sons, and a daughter.

Complete List of A.S.T.M. Emergency Specifications and Emergency Alternate Provisions

Editor's Note.—To provide a readily accessible and convenient reference for members who wish to have a complete list of all emergency specifications and emergency alternate provisions (pink slips) each issue of the Bulletin will give the latest list at the time the Bulletin goes to press. This feature suggested by the Executive Committee will appear as the last page or two of Bulletin text immediately preceding the professional card page in the back advertising section.

January 30, 1943

Emergency Specifications for[1]

ES-1a	Lead-Coated and Lead-Alloy Coated Copper Wire for Electrical Purposes.
ES-2	Lead Coating (Hot-Dip), on Iron or Steel Hardware.
ES-3	Conducting Salt Spray Tests on Organic Protective Coatings. (Method)
ES-4	*Discontinued*, Replaced by Standard Hardness Conversion Table for Cartridge Brass. (Relationship Between Diamond Pyramid Hardness, Rockwell Hardness, and Brinell Hardness) (E 33-42)
ES-5a	Carbon-Chromium Ball and Roller-Bearing Steels.
ES-6	Rubber Sheath Compound for Electrical Insulated Cords and Cables Where Extreme Abrasion Resistance Is Not Required.
ES-7	Fire-Refined Copper for Wrought Products and Alloys.
ES-8	85 Per Cent Magnesia Thermal Insulating Cement.
ES-9	Long Fiber Asbestos Thermal Insulating Cement.
ES-10	Mineral Wool Thermal Insulating Cement.
ES-11	Expanded or Exfoliated Mica Thermal Insulating Cement.
ES-12	Diatomaceous Earth Thermal Insulating Cement, for Use from 600 to 1200 F.
ES-13	Diatomaceous Earth Thermal Insulating Cement, for Use from 1200 to 1900 F.
ES-14	Blanket Thermal Insulation for Building Purposes.
ES-15	Blanket Thermal Insulation for Industrial Purposes.
ES-16	Blanket Thermal Insulation for Refrigeration.
ES-17	Preformed Pipe Covering Thermal Insulation.
ES-18	Preformed Block Thermal Insulation.
ES-19	Structural Board Thermal Insulation.
ES-20	Malleable Iron Flange, Pipe Fittings, and Valve Parts.

Emergency Alternate Provisions in Specifications for[2]

Steel

EA-A 1	Open-Hearth Carbon-Steel Rails (A 1-39).[7]
EA-A 21	Carbon-Steel Axles for Cars and Tenders (A 21-39).[8]
EA-A 25a	Wrought Steel Wheels for Electric Railway Service (A 25-41).[9]
EA-A 26	Steel Tires (A 26-39).[6]
EA-A 27	Carbon-Steel Castings for Miscellaneous Industrial Uses (A 27-42).[5]
EA-A 53	Welded and Seamless Steel Pipe (A 53-42).[10]
EA-A 57	Multiple-Wear Wrought Steel Wheels (A 57-39).[7]
EA-A 67	Steel Tie Plates (A 67-33).[7]
EA-A 83	Lap-Welded and Seamless Steel and Lap-Welded Iron Boiler Tubes (A 83-42).[8]
EA-A 87	Carbon-Steel and Alloy-Steel Castings for Railroads (A 87-42).[5]
EA-A 120	Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses (A 120-42).[8]
EA-A 134	Electric-Fusion-Welded Steel Pipe (Sizes 30 in. and Over) (A 134-42).[8]
EA-A 135	Electric-Resistance-Welded Steel Pipe (A 135-42).[8]
EA-A 139	Electric-Fusion-Welded Steel Pipe (Sizes 8 in. to but not Including 30 in.) (A 139-42).[8]
EA-A 148	Alloy-Steel Castings for Structural Purposes (A 148-42)[5].
EA-A 160	Axle-Steel Bars for Concrete Reinforcement (A 160-39).[7]
EA-A 161	Seamless Low-Carbon and Carbon-Molybdenum Steel Still Tubes for Refinery Service (A 161-40).[8]
EA-A 167	Corrosion-Resisting Chromium-Nickel Steel Sheet, Strip, and Plate (A 167-42).[7]
EA-A 177	High-Strength Corrosion-Resisting Chromium-Nickel Steel Sheet and Strip (A 177-42).[7]
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[1] Available in separate pamphlet form and also published in 1942 Book of Standards.

[2] Available as "pink slips" affixed to each of the separate respective specifications and published in various issues of the ASTM Bulletin as indicated by footnotes. Complete set to be furnished with respective parts of the 1942 Book of Standards.

[3] December, 1941 ASTM Bulletin.

[4] January, 1942 ASTM Bulletin.

[5] March, 1942 ASTM Bulletin.

[6] May, 1942 ASTM Bulletin.

[7] August, 1942 ASTM Bulletin.

[8] October, 1942 ASTM Bulletin.

[9] December, 1942 ASTM Bulletin.

[10] January, 1943 ASTM Bulletin.

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Die Casting for Engineers

THIS IS THE title of a new book, issued by The New Jersey Zinc Co., 160 Front St., New York, N. Y., providing in convenient form information which should be of assistance to engineers in industry who wish to become more familiar with this rapidly expanding process; it should be of help also to engineering students. An attempt has been made to present an impartial analysis of commercial alloys, so that intelligent use can be made of the inherent advantages of the process.

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